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FURTHER NOTES ON ACACIA IN QUEENSLAND

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Summary

Acacia tephрина and *A. handonis* are described as new. *A. lazaridis* is a new name for *A. brevifolia* (F. Muell. ex Benth.) Benth. non (Lodd.) G. Don. *A. clivicola* Pedley is referred to *A. stowardii* Maiden which is distinguished from *A. duriuscula* W.V. Fitzg. *A. difficilis* Maiden and *E. estrophiolata* F. Muell., recorded from Queensland for the first time, are described. Notable extensions to the ranges of *A. cincinnata* F. Muell. and *A. solandri* Benth. and an additional specimen of *A. ramiflora* Domin are recorded. *A. angustissima* (Miller) Kuntze is recorded as an occasional weed in tropical Queensland though its deliberate introduction is also noted.

The numbers assigned to species are those of my revision of the Queensland species (Pedley 1978, 1980). Additional species have been given "A" numbers next to their supposed nearest relative, except for *A. angustissima* which has no near relatives in Australia.

45. *Acacia stowardii* Maiden, J. & Proc. Roy. Soc. N.S.W. 51:269 (1917). **Syntypes:** Western Australia: Comet Vale, 63 miles N of Kalgoorlie, Dec 1916, *T.J. Jutson* 175 and without date, *Jutson* 281 (PERTH, fragments & photos of each).

A. clivicola Pedley, Contrib. Qd Herb. 15:7 (1974), Austrobaileya 1:155 (1978), *syn. nov.* **Type:** Gregory South District: near Pinkilla, about 40 miles (64 km) from Quilpie on Windorah Road, Mar 1960, *Johnson* 1508 (BRI, holo; NT, iso).

When describing *Acacia aprepta* I considered its relationship with *A. stowardii* but more recently Mr. B.R. Maslin, who is preparing an account of *Acacia* for a forthcoming "Flora of Central Australia", drew my attention to the resemblance of *A. clivicola* to *A. stowardii* and to *A. duriuscula* W.V. Fitzg. He made available specimens from Western Australia and I examined specimens from the Northern Territory, South Australia and Queensland as well.

I have seen fragments and photographs of the type specimen of *A. stowardii* as well a range of material* collected in the Kalgoorlie-Menzies area and a large number of specimens identified as *A. clivicola*. The types of *A. stowardii* and *A. clivicola* are remarkably similar in the size and indumentum of the branchlets and young shoots, the size and shape of the pods and above all the size, shape and nervature of the phyllodes. The two are certainly conspecific. In the protologue of *A. stowardii* Maiden compared it with *A. duriuscula*, Maiden often compared species he described with others not closely related but in this case comparison of the two species was warranted. He wrote "There is a good deal of external similarity between these two species, but if we examine them carefully, we find that flowers in spikes are unknown in *A. duriuscula*, while the calyx is more than half as long as the corolla in that species, and not half as long in *A. stowardii*. The phyllodes of *A. duriuscula* are shorter and more resinous, though in neither species is it [resin] abundant; those of *A. duriuscula* are less smooth to the touch, as the venation is coarser, i.e. the veins are thicker and more prominent, yet in both it would be termed fine". Examination of a type specimen of *A. duriuscula* (Coolgardie district, in 1902, *Kelso*. PERTH), confirmed

* Board 6506; Campbell s.n.; Hall H76/61; Maslin 1932, 1934, 1948 & 2408; Wilson 6507 (all PERTH).

Maiden's observations. The heads of *A. duriuscula* are not at all elongate whereas those of *A. stowardii* are at least ovoid; the calyx resembles that of *A. stowardii* in size, degree of lobing, texture and indumentum but is slightly less than half as long as the corolla whereas that of *A. stowardii* often ranges from one-third to one-half as long; and the phyllodes are shorter than is usual in *A. stowardii*. None of these characters would however exclude *A. stowardii* absolutely from *A. duriuscula* but the nervature of the phyllodes of the two species is sufficiently different to distinguish them. Throughout its range, which extends over about 28° longitude, *A. stowardii* has rather thick phyllodes finely striate with numerous parallel nerves (10–11/mm across the phyllode on the type specimens) while *A. duriuscula* has more widely spaced translucent nerves (5–6/mm).

The type specimen is the only one that I have seen that I would refer with certainty to *A. duriuscula*. Further collections are needed to confirm the observations on the nervature of the phyllodes and to determine what the pods are like.

There is a problem, already recognised (see above p. 155), in distinguishing *A. stowardii* from *A. kempeana*. The latter usually has wider pods and phyllodes but as specimens often do not have pods the width of the phyllodes is often the only criterion for separating the species. The phyllodes of *A. kempeana* are more than 5 mm and those of *A. stowardii* are (on most specimens) less than 4 mm wide. A few specimens, particularly from the south-western part of the Northern Territory [Maconochie 1844 (BRI, NT, PERTH) Latz 5237 (BRI, NT, PERTH) Woenne s.n. (PERTH)], with phyllodes 4–5 mm wide may represent intermediates between *A. stowardii* and *A. kempeana*, Ecological data on the herbarium labels suggest however that they are *A. stowardii*.

47. *A. solandri* Benth.

NORTH KENNEDY DISTRICT: Hervey Holding, Paluma Range, approx. 19°15'S 146°25'E, rainforest, Jun 1975, Hyland 3007; Inkerman Hill [19°45'S, 147°30'E], Mar 1975, Jackes (JCT). SOUTH KENNEDY DISTRICT: Clarke Range west of Cathu, approx 20°40'S, 148°30'S, Apr 1978, Byrnes 3804 & Clarkson.

Acacia solandri extends farther north in Queensland than previously supposed. It occurs in rainforest and in drier situations such as Mt Stuart near Townsville.

53A. *Acacia difficilis* Maiden in Ewart & Davies, Flora North. Territory 344 (1917).

Type. NORTHERN TERRITORY: Howard Creek, 20 miles SE of Darwin, Jun 1916, Hill (not seen).

Tree to 8 m tall but flowering when only 1 m; branchlets glabrous or often tomentose the indumentum usually persisting in upper axils, occasionally with brown scurf on developing phyllodes and tips of branches. Phyllodes straight or falcate and tapering into a long pulvinus when narrow, 9–12(–16) cm x 2–4(–5) cm, (2–)3–6 times as long as wide, with many fine crowded slightly anastomosing nerves, 3 or 5 more prominent than the rest, glabrous or tomentose; gland prominent basal, pulvinus 4–10(–17) mm long. Spikes dense (2–)3–4(–4.5) cm long on peduncles 3–8 mm long often arranged in complex inflorescences. Occasionally the spikes are in pairs in the upper axils but usually they are at the base of an axillary shoot up to 5 cm long which may bear 2–5 lateral spikes. Occasionally two pairs of spikes and two shoots develop in each axil and the upper phyllodes are reduced in size so that a complex paniculate inflorescence develops. Flowers 5–merous; calyx lobes extremely narrowly spatulate ± free, ciliolate at the apex, 0.5–0.7 mm long; corolla glabrous 0.9–1.2 mm long about twice as long as the calyx; stamens ca 3 mm long; ovary tomentose. Pods similar to those of *A. julifera*, ± terete, longitudinally wrinkled, glabrous, to 13 cm long, 3 mm diam. Seeds longitudinal, ca 6 x 2.2 mm; areole open; funicle folded and thickened, basal.

BURKE DISTRICT: Settlement Creek, Jun 1923, Brass 352.

Acacia difficilis is widely spread in the northern part of the Northern Territory where it occurs on sandy soils often with *Eucalyptus nesophila* or *Grevillea pteridiifolia* and on alluvia. It has been collected only once in Queensland. The main flowering period is July-August and fruits mature from August to October.

It is difficult to distinguish from *Acacia tumida* Benth. which has shorter flattened pods and often glaucous branchlets. Its closest relative is *A. julifera* which is also densely tomentose in its young stages. The Queensland specimens referred to in the protologue of *A. difficilis* are *A. julifera* subsp. *gilbertensis*.

63. *Acacia lazaridis* Pedley, nom. et stat. nov. Based on *Acacia aulacocarpa* Cunn. ex Benth. var. *brevifolia* F. Muell. ex Benth., J. Proc. Linn. Soc. Bot. 3:144 (1859). **Type:** Suttor, Mueller 39 (K, holo).

A. brevifolia (F. Muell. ex Benth.) Benth., Fl. Aust. 2:395 (1864); Pedley, *Austrobaileya* 1(2):167 (1978) nom. illeg. non Lodd. ex G. Don, Gen. Hist. Dichlam. Pl. 2:406 (1832).

Bentham (Fl. Aust. 2:373. 1864) referred *A. brevifolia* Lodd. to *A. lunata*. Lodige's name is a *nomen nudum*, but it was validated with a brief description by G. Don. Consequently *A. brevifolia* (Benth.) Benth. is a later homonym. I am indebted to Mr. B.R. Maslin for pointing out Don's description of *A. brevifolia*.

The species is named for Mr. M. Lazarides (CANB) who is well known for his work on Australian grasses and whose collections in northern Australia have been invaluable in studies in many groups including *Acacia*.

65. *A. cincinnata* F. Muell.

SOUTH KENNEDY DISTRICT: Foot of Eungella Range, 21°05'S 148°38'E, rainforest margin, May 1970, Telford 1816 (Canb. Bot. Gard. 034602); East Funnel Creek (approx. 21°40'S 148°50'E) cleared rainforest planted to pasture, Nov. 1978 Anderson 630.

As expected (see p. 169) *A. cincinnata* has been collected in the vicinity of Mackay where it is associated with rainforest.

96. *Acacia cana* Maiden, J. & Proc. Roy. Soc. N.S.W. 53, errata (1920); Pedley, *Austrobaileya* 1:196 (1978).

Tree to ca 6 m tall with dense spreading crown; branchlets obscurely angular, grey with indumentum of dense short appressed hairs. Phyllodes straight, linear, acute, \pm pungent (3—)4.5—10 cm long, (1.5—)2—3.3(—4) mm wide, 15—35(—50) times as long as wide, with many fine longitudinal nerves hidden at first by dense indumentum of appressed hairs which are absent from old phyllodes. Heads of 25—30 flowers on penduncles 7—10(—12) mm long in pairs in the upper axils or 2—3 in axillary racemes, the axis ca 2.5 mm long sometimes growing out into a leafy shoot with heads on single axillary peduncles. Flowers 5—merous; calyx eventually splitting into narrowly oblong or concave spatulate lobes 0.6—0.8 mm long appressed pubescent in the upper part; corolla 1.4—1.6 mm long, 2—2.5 times as long as the calyx, appressed pubescent; stamens 2.5 mm long; ovary densely tomentose. Pods (immature) flat with prominent raised yellowish margins, curved, up to 10 cm long, ca 4 mm wide, appressed pubescent; seeds longitudinal with funicle folded into basal aril.

New South Wales. WESTERN PLAINS: Battery Creek, "Gumvale" via Tibooburra, Sep 1970, Hitchcock NSW 106277 (BRI); 1 mile E of "Gumvale" homestead, near Tibooburra, Sep 1971, Perry 5746 (BRI); Depot Glen, Milparinka, 29°42'S 141°45'E, Sep 1973, Cunningham 1087 & Milthorpe (NSW): "Mulga Valley" Stn on road between White Cliffs and "Tero Creek" Stn, Dec 1968, Martensz CSIRO Div. Wildlife Res. 4132 (NSW); White Cliffs, Sep 1906, O'Reilly NSW 101392 (BRI); Bunker Creek on Wilcanina-White Cliffs Road, Oct 1974, Cunningham 2952 & Milthorpe (BRI). **Queensland:** Warrego District: "Avonvilla" N. of Adavale, Apr 1961, Wilson (BRI, K).

Acacia cana is found in the extreme north-west of New South Wales usually on drainage lines, and has apparently been collected once in Queensland. The specimen has extremely young heads and it has not been possible to determine the structure of the calyx, but long peduncles and pointed phyllodes indicate that it is *A. cana*. The great bulk of the Queensland material previously referred to *A. cana* is now referred to *A. tephрина*.

96A. *Acacia tephрина Pedley. **Type.** BURKE DISTRICT: 10 miles N of Hughenden, Jun 1975, *Lazarides* 3613 (BRI, holo; CANB, K, iso).

Tree usually erect up to 20 m tall, silvery, bark dark grey, fissured and flaky; branchlets slender, angular, with dense indumentum of short appressed hairs wearing off on angles, often glabrescent. Phyllodes straight or slightly falcate, linear though sometimes widest above the middle when broad, not sharply pointed, 7–11(–15) cm long, 2.5–4.5(–6) mm wide, 20–35(–60) times as long as wide, many fine longitudinal nerves, densely appressed pubescent, hairs on old phyllodes confined to intercostal lines. Heads of 20–35 flowers in densely pubescent axillary 4–10-branched racemes, the axis 2.5–8 mm long, branches 4–7(–10) mm long. Flowers 5-merous; calyx 0.3–0.5 mm long with appressed pubescent lobes $ca\ 1/3$ as long as the calyx, sometimes pubescent; stamens $ca\ 2.5$ mm long; ovary densely tomentose, glabrous when aborted. Pod linear, flat, slightly, contracted between seeds and convex over them, densely appressed pubescent, up to 6.5 cm long and 5 mm wide; seeds longitudinal, 5.5 x 3.5–4 mm; areole central, open; funicle $ca\ 3$ times folded forming small basal aril.

Queensland. BURKE DISTRICT: 10 miles [16 km] N of Hughenden, Jun 1965, *Lazarides* 3613 (BRI, CANB, K); 10 km S of Hughenden, *Kent* 71 (BRI); Hughenden, Jun 1934, *Blake* 6226 (BRI). COOK DISTRICT: 4 miles [6 km] SE of Einasleigh, Jun 1966, *Pedley* 2113 (BRI). NORTH KENNEDY DISTRICT: $ca\ 10$ miles [16 km] W of Bowen, Jun 1958, *Pedley* 266 (BRI, K); Guthulungra, 19°56'S 147°50'E, May 1974, *Thompson* (BRI). MITCHELL DISTRICT: Glenhurst near Blackall, May 1936, *Everist & White* 65 (BRI). SOUTH KENNEDY DISTRICT: 90 km (by road) N of Clermont, 22°04'S 147°34'E, Jun 1972, *T.J. McDonald* 558 (BRI); "Kiandra" 32 miles [51 km] N of Clermont, Aug 1964, *Pedley* 1739 (BRI). GREGORY SOUTH DISTRICT: Grey Range, between Quilpie and Eromanga, May 1928, *White* (BRI, K); "Whynot", Nov 1957, *Everist* 5663. WARREGO DISTRICT: Cowley — Boorara Road, 26°54'S 144°50'E, Jun 1955, *Smith* 6387 (BRI, K).

I have seen two collections of what may be an undescribed species allied to *A. tephрина*. Only a few phyllodes on the specimens were intact but they appeared to be more elongate (10–16 cm long, 33–35 times as long as wide) than is usual in *A. tephрина* though within the range of variation of that species. The axillary racemes appear to have fewer heads and there appear to be significant differences in the flowers. The calyx is 0.6–0.9 mm long, shortly obtusely lobed, glabrous or with

* *Acacia tephрина* Pedley, species nova affinis *A. canae* Maiden phyllodiis non pungentibus ramis racemorum paucibus et calyce in lobos discretos non secedente differt. **Typus:** *Lazarides* 3613 (BRI, holotypus; K, CANB, isotypi).

Arbor plerumque erecta usque 20m alta argentea cortice atrocinerea fissurata et squamata; ramuli tenues angulares indumento pilorum brevium appressorum in angulis evanescenti obsiti saepe glabrescentes. Phyllodia recta vel leviter falcata linearia quamquam ubi lata interdum latissima supra medium non valde acuta, 7–11(–15) cm longa, 2.5–4.5(–6) mm lata, 20–35(–60) plo longiora quam latiora, nervis multis tenuibus longitudinalibus, dense appresse pubescentia, pilis in phyllodiis veteribus lineam intercostatem limitatis. Capitula 20–30 florum in racemos dense pubescentes axillares 4–10 ramosa disposita ex axe 2.5–8 mm longa, ramis 4–7(–10) mm longis constantes. Flores 5-meri; calyx 0.3–0.5 mm longus lobes appresse pubescentibus calyce toto 3plo brevioribus; corolla 1.3–1.5 mm longa interdum pubescens (2–)2.5–4plo calyce longior; stamina circa 2.5 mm longa; ovarium dense tomentosum, glabrum ubi abortum. Legumen lineare planum inter semina leviter contractum et convexum supra ea, dense appresse pubescens usque 6.5 cm longum et 5 mm latum; semina longitudinalia 5.5 x 3.5–4 mm; areolus centralis apertus; funiculus circa 3plo plicatus arillum parvum basilem faciens.

some longish white hairs on the tube and with dense shorter golden hairs on the lobes. The corolla is 1.4–1.8 mm long, about twice as long as the calyx. Pods are needed to clarify its position relative to *A. tephрина* and other species of the *Microneuræ* group. Both collectors noted that the plant grows in thickets. The specimens seen were:

Western Australia. CARNEGIE DISTRICT: East of Lewis Range (approx. 20°10'S 128°40'E), June 1968, *Beard* 5571 (PERTH). **Northern Territory:** 117 km W of Hookers Creek, 18°12'S 129°44'E, July 1973, *Maconochie* 1749 (BRI, PERTH, specimens also at AD, B, CAN, DNA, K, NSW, NT).

Despite the note to the contrary (Pedley 1978, p. 196) the plant generally known in Queensland as *Acacia cana* is not conspecific with *A. cana* from New South Wales. Mr. B.R. Maslin demonstrated to me that specimens at herb. Kew should be referred to two species, true *A. cana* and an undescribed species (*A. tephрина*) from Queensland. Observations at Kew were subsequently confirmed with specimens borrowed from NSW.

A. cana has more sharply pointed, often narrower, phyllodes, inflorescences with fewer longer branches and calyxes when split into distinct lobes. Except for the reference to Milparinka plants, notes previously published under *A. cana* refer to *A. tephрина*.

114. *Acacia ramiflora* Domin

BURKE DISTRICT: 5 miles [8 km] E of Hughenden, pebbly red earth soil in low open woodland of *Eucalyptus whitei* and *Triodia* sp., Apr 1971, *Birch* 71/49 (JCT).

The specimen cited extends the known range of *A. ramiflora* only slightly. The species should be looked for in the Pentland-Hughenden area. More material is required to assess its relationship with *A. simsii*.

118A. *Acacia estrophiolata* F. Muell., South. Sci. Record 2:150 (1882). Type: Northern Territory: Finke River, *Kempe* (NSW, iso).

Tree, often strongly weeping, to 12 m tall; branchlets slender \pm terete, glabrous with the epidermal layer often lifting off. Phyllodes straight linear acute, 6–12 cm \times 1.7–4(–5) mm, 17–40(–50) times as long as wide, with 3 widely spaced longitudinal nerves with indistinct reticulate veins between them; gland at some distance (5–25 mm) from the base with the margin distinctly bent at the gland and occasionally 1 or 2 more distal glands; pulvinus 1–2 mm long. Heads of ca 40 flowers in peduncles, subtended by an obtuse concave bract, 7–10 mm long in pairs in the upper axils. Flowers 5–numerous; calyx lobes \pm free spatulate, glabrous 0.8–1 mm long; corolla ca 1–2 mm long; stamens ca 3 mm long; ovary glabrous. Pods flat moniliform, the valves rather membranous; long wide. Seeds longitudinal ca 5 \times 4 mm, funicle hardly thickened, areole small central open paler than the rest of the seed.

GREGORY NORTH DISTRICT: no definite locality (approx. 24°20'S 138°20'E), *Gasteen*.

Acacia estrophiolata is common in the southern part of the northern Territory usually on sandy alluvia or on run-on areas. It flowers in April and May. It is so closely related to *A. excelsa* subsp. *angusta* that subspecific rank might be considered appropriate, but as the phyllodes of *A. estrophiolata* are always longer than those of *A. excelsa* and their geographic ranges are distinct specific rank is maintained.

The exact locality of Gasteen's collection is not known, but it is in the north-eastern part of the Simpson Desert within 200 km of collecting localities of *A. estrophiolata* in the Northern Territory.

152A. **Acacia handonis* Pedley, Type: DARLING DOWNS DISTRICT: Barakula State Forest (approx. 26°20'S 150°30'E), 15 Nov 1978, *V. Hando* s.n. (BRI 233624, holo).

Subshrub with branchlets ribbed below the insertion of the phyllodes, with scattered short glandular hairs and occasionally with denser simple hairs. Phyllodes crowded spirally arranged and occasionally subverticillate, probably semiterete when fresh subquadrangular and \pm similar to those of *A. baueri* when dry, without obvious nerves, recurved and mucronate at the apex, 6–10(–12) mm long, 0.3–0.4 mm thick; gland apparently absent; pulvinus *ca* 0.2 mm long. Heads of *ca* 30 flowers on axillary peduncles 8(–16) mm long. Flowers 5–merous, glabrous and glutinous; calyx 0.6–0.8 mm long, lobed to about the middle; corolla 1.8–1.9 mm long, 2–3 times as long as the calyx; stamens *ca* 3.5 mm long; ovary glabrous. Pod shortly stipitate, flattened glabrous with prominent raised cartilaginous excrescences on valves. Seeds longitudinal *ca* 4 mm long, 1.7–1.9 mm wide; areole large oblong open; funicle basal thick fleshy folded.

DARLING DOWNS DISTRICT: Barakula area, Aug-Sep 1977, *J.G. & M. Simmons* 896.

Acacia handonis is an extremely rare species. I have examined specimens from the only known population north of Chinchilla. Flowers have been collected in July and August and mature fruits in November. The species resembles *A. brunioides* but its unusual pod sets it apart from that species and all others I have examined.

The plant is named in honour of Mrs. V. Hando who collected specimens for me.

236. *Acacia angustissima* (Miller) Kuntze, Rev. Gen. Pl. 3(2):47(1898); Woodson & Schery, Ann. Missouri Bot. Gard. 37:268(1950) et fide Isely synonyma ibi enumerata; Isely, Sida 3:368(1969). Based on *Mimosa angustissima* Miller, Gard. Dict. ed. 8(1768). Type: not seen (BM, fide Isely).

COOK DISTRICT: Bamaga near Cape York, Aug 1964, *Christensen*. NORTH KENNEDY DISTRICT: Millaroo Research Stn, *ca* 30 miles [48 km] SW of Ayr, Aug 1964, *Seton*. SOUTH KENNEDY DISTRICT: Alligator Creek, near Mackay, Sep 1957, *Goodchild*.

Acacia angustissima, a native of subtropical and tropical America, has been collected three times in Queensland. On one occasion it was suspected of being introduced from outside Australia in forage legume seed. It has not proved troublesome and seems not to have persisted. It may be of value as a forage plant and in recent years it has been deliberately introduced. At present plants from three different introductions are being grown at the Walkamin Research Station of the Department of Primary Industries, near Mareeba. Details of the original introductions with Commonwealth Plant Introduction numbers are:

CPI 40175 BOLIVIA: La Basuela, alt 2100m, Jun 1965, *R.J. Williams* 5047.

CPI 51651 ARIZONA: Desert Botanic Gardens, Phoenix, introduced in 1971.

CPI 57959 NETHERLANDS LESSER ANTILLES: Curacao, introduced in 1972, *Arnoldo-Broeders*, Fraterhuis Soto.

* *Acacia handonis* Pedley, species nova affinis *A. brunioidis* Cunn ex G. Don pagina valvorum leguminis crescentibus cartilagineis praedita (ramentacea) et seminibus longitudinalibus differt. **Type:** *V. Hando* s.n. (BRI 233634, holo).

Fruticulus ramulis costatis infra insertionem phyllodiorum pilis sparsis brevibus glandulosus et interdum confertioribus simplicibus vestitus dispersis. Phyllodia conferta spirallitè disposita et interdum subverticillata, probabiliter semiteretia ubi viva subquadrangularia et similis eorum *A. baueri* ubi secca, sine nervis manifestis, recurvata et mucronulata ad apicem, 6–10(–12) mm longa, 0.3–0.4 mm crassa; glans nulla ut videtur; pulvinus *ca* 0.2 mm longus. Capitula 30flora in pedunculo axillari 8(–16) mm longo disposita. Flores 5meri glabri et glutinosi; calyx 0.6–0.8 mm longus ad fere medium lobatus; corolla 1.8–1.9 mm longa, 2–3plo longior quam calyx; stamina circa 3.5 mm longa; ovarium glabrum. Legumen breviter stipitatum applanatum glabrum excrescentibus prominentibus cartilagineis in valvis ornatum circa 4.5 cm longum, 4 mm latum. Semina longitudinalia circa 4 mm longa, 1.7–1.9 mm lata; areolus grandis oblongus apertus; funiculus basalis plicatus crassus succulentus.

A. angustissima differs from all other species found in Queensland in having rather oblong heads of almost white flowers (with short pedicels) in paniculate inflorescences and bipinnate leaves without glands.

A number of infraspecific taxa has been described; for example, Isely recognised six varieties occurring in the United States, and there is no general agreement on either the status of these taxa or of the circumscription of *A. angustissima*. I have taken a broad view of the species as there is a need for it to be critically studied throughout its range.

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FLORAL MORPHOLOGY IN RELATION TO POLLINATION ECOLOGY IN FIVE QUEENSLAND COASTAL PLANTS

By Richard B. Primack,¹ Norman C. Duke,² and P.B. Tomlinson³

Abstract.

Observations of pollination by birds in *Acanthus ilicifolius* and *Lysiana subfalcata* var. *maritima*, hawkmoths in *Clerodendrum inerme* and *Sonneratia alba*, and bees in *Sesuvium portulacastrum*, are presented along with detailed descriptions of floral morphology and pollination efficiency using pollen/ovule ratios. Self-fertilization is restricted in *Sesuvium*, *Acanthus*, and *Clerodendrum* by protandry, while the flowers of *Lysiana*, *Sonneratia*, and *Acanthus* are morphologically incapable of automatic self-pollination. The high fruit set seen in flowers of these species suggests that these species are self-compatible. Self-compatibility in mangrove and mangrove-associated species will presumably allow some fruit set even in isolated, single plants after a new habitat is colonized.

Information on the reproductive biology of plants forming or often associated with mangrove communities has generally been limited to the fruit dispersal stage (see Guppy, 1906; Rabinowitz, 1978). Recent studies in Australia have shown an extensive array of floral adaptations in relation to different pollinator visitors and plant-animal interrelationships in the genus *Lumnitzera*, Combretaceae (Tomlinson *et al.*, 1979) and the tribe Rhizophoreae of the family Rhizophoraceae (Primack and Tomlinson, 1978; Tomlinson *et al.*, 1979). The present study reports on the floral morphology, pollination ecology, and fruit set of five species found in the mangrove or other coastal vegetation of northern Queensland. This information provides a better understanding of the dynamic interactions among plants and animals in and near the mangrove forest.

MATERIALS AND METHODS

Observations were made at Cape Ferguson, near Townsville, Queensland (19°4'S, 147° 17'E) during March and April 1978. The methods for determining pollen/ovule ratios and stigma receptivity have been described by Tomlinson *et al.* (1979). To summarize, the number of pollen grains per flower was determined either by direct count of macerated anthers or with a Coulter Counter, and of ovules by direct dissection. The onset of stigma receptivity was determined by floating stigmas in (a) α -naphthyl acetate, and observing a color reaction at the stigma surface, indicative of esterase activity by a coupling with (b) hexazotised pararosanilin.

Descriptions of floral characters directly related to pollination were made using fresh material, but the illustrations were prepared from fluid-preserved material. All information on flower phenologies and pollinator visits were made on natural populations. Collections were made of insect visitors to these flowers; these insects were identified by members of the C.S.I.R.O. Division of Entomology, Canberra. Fruit set was determined for three species by tagging either flower buds about to open or open flowers in April 1978, and returning two weeks later to check for developing fruit. Information on the growth habit, typical habitat, and geographical distribution of each species is presented in Table 2.

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SONNERATIA ALBA J. SM. (SONNERATIACEAE)

This is a tree of the seaward community of mangroves with the flowers conspicuous and terminal on the ultimate branches (Fig. 12). Each flower has approximately 300 stamens which form the attractive part of the flower; each stamen is about 25 mm long. Some of the stamens point outward, while others are angled inward, forming a network of filaments about 30 mm in length over the ovary (Fig. 12D). The stamens are partially supported by the five thick, green calyx lobes, which are often purple at the base. The style extends beyond the anthers, then bends upward, and ends in a sticky, disc-shaped stigma. Automatic self-pollination is minimized because the stigma extends beyond the anthers. Many drops of nectar accumulate along the margin of the ovary.

The flowers last only one night, they open at dusk or just after dusk and are often orientated towards the setting sun. The following morning the stamens fall off and the stigma discolors. About one hour after the flower opens, a sour-milk odor is produced and the anthers begin to dehisce. The light, powdery pollen is produced in very large quantities (500,000 grains per flower). Bees sometimes land on the opening flowers but are generally unable to penetrate the tangle of filaments and do not contact the stigma.

Hawkmoths were observed visiting the flowers, and appear to be the primary pollinators in this area. Alighting for only a few seconds on a flower before resuming flight, moth activity was relatively low. Individual flowers probably were visited no more than twice during the two hours over which observations were made; however, this is presumably sufficient for pollen transfer to take place. Two hawkmoths of the same species (*Psilogramma menephron menephron* [Cramer]) were captured, averaging 1.3 g in weight, and 88, 87 and 56 mm for proboscis length, wing-span, and body length respectively. A proboscis of this length would allow the hawkmoth to take nectar from a distance.

Of 46 flower buds tagged in this species, forty-one developed into young fruit; fruit set was 89%.

CLERODENDRUM INERME GAERTN. (VERBENACEAE)

This is a sprawling shrub of mangrove margins with white flowers in corymbose cymes, with the two to eight flowers in each cyme held horizontally in a single plane (Fig. 13). The corolla has five reflexed lobes and a tube 30 mm long, 15 mm wide at the opening, and 1.4 mm wide at the base. On the inner surface, the corolla tube is densely covered with short fine hairs, presumably to keep out unwanted flower visitors. The calyx forms a cup which extends above the ovary and is covered with an irregular series of raised elliptical glands which apparently function as extra-floral nectaries, since ants are commonly observed feeding at them. Four stamens extend 30 mm from the corolla mouth when the flower first opens (Fig. 13A). The included part of the filaments is white, the excluded part is purple. Each versatile anther sac splits longitudinally in the middle, exposing the thick yellow back of the anther and pulling pollen into a groove formed between the split anther edge and the back of the anther. After the first day and night, the stamens wither away and the filaments roll up. The style is only about 30 mm in length at anthesis, increasing to 60 mm by the second or third day, when the two stigma lobes diverge and the flower becomes receptive to pollen (Figs. 13B, C). These flowers are therefore strongly protandrous, with limited chance of pollen being transferred from anther to stigma within the same flower. Further, all flowers in a single inflorescence generally remain at the same developmental stage, so that flowers on the same inflorescence are unlikely to pollinate each other, though inflorescences at different developmental stages are often

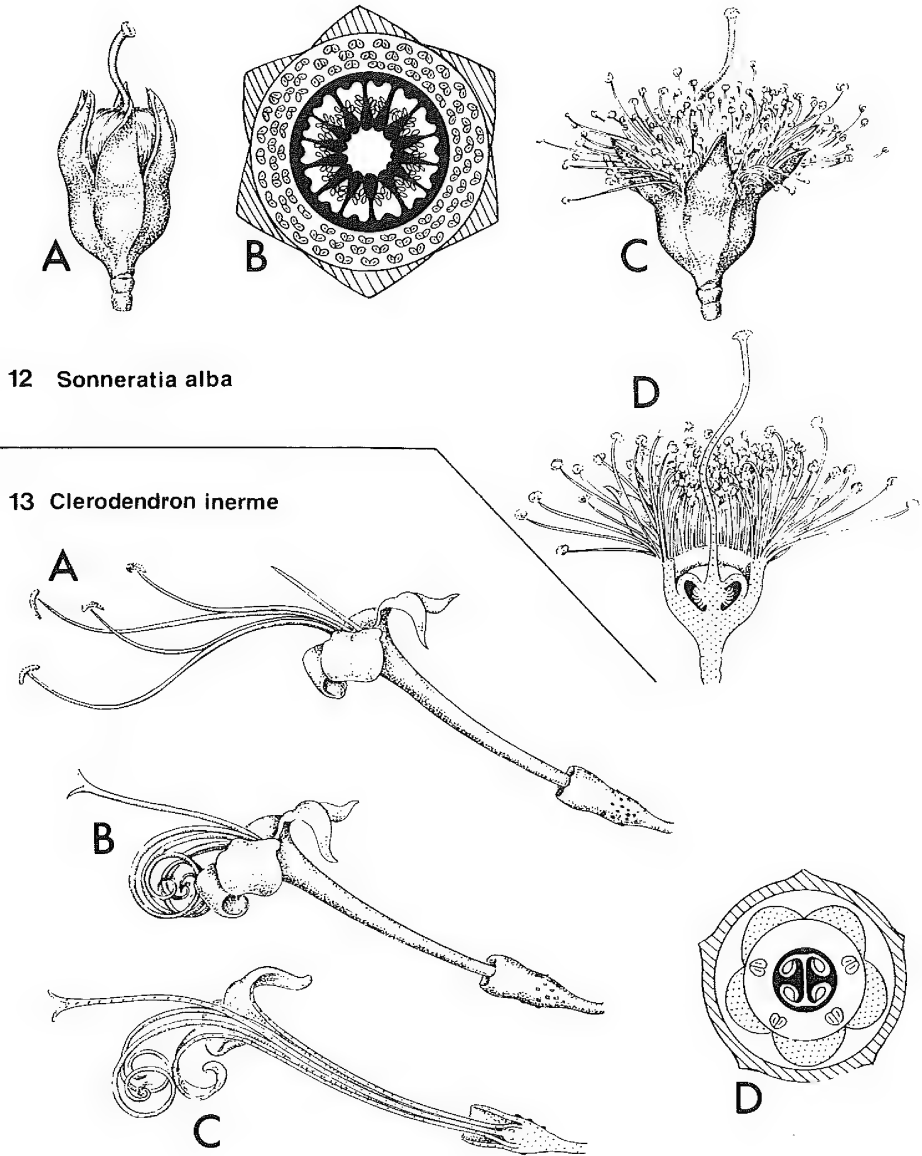


Figure 12. *Sonneratia alba* J. Sm. (from fluid-preserved material, Cape Ferguson, Townsville, Queensland). **A**. Opening flower bud (x 2/3). **B**. Floral diagram. **C**. Open flower (x 2/3) at anthesis from the side. **D**. Open flower (x 2/3) in longitudinal section.

Figure 13. *Clerodendron inerme* Gaertn. (from fluid-preserved material, Cape Ferguson, Townsville, Queensland). **A**. Flower (x 2) at anthesis (male phase) from the side. **B**. Flower (x 2) at female phase from the side. **C**. Flower (x 2) at female phase in longitudinal section. **D**. Floral diagram.

found on the same plant. The stigma of a single flower may be receptive from one to several days, with individual flowers lasting three to five days.

The flowers are very fragrant. No daytime visitors to the flowers were observed in several hours of observation. In two hours of observation at and just after dusk, one large hawkmoth was the only flower visitor to a large flowering bush. The hawkmoth appeared and departed suddenly. In this brief visit, the hawkmoth probed virtually every flower on the bush, spending only a second or two on each flower.

Adaptations for hawkmoth pollination appear to be the long corolla with hairy interior to exclude other insects. The white corolla and strong fragrance presumably aid the hawkmoths to locate the flowers. The versatile anthers with pollen in grooves, allows the pollen to be placed precisely on the hawkmoth proboscis. The purple color of the filament and style presumably make them difficult for the hawkmoth to see and avoid. No data was obtained on fruit set.

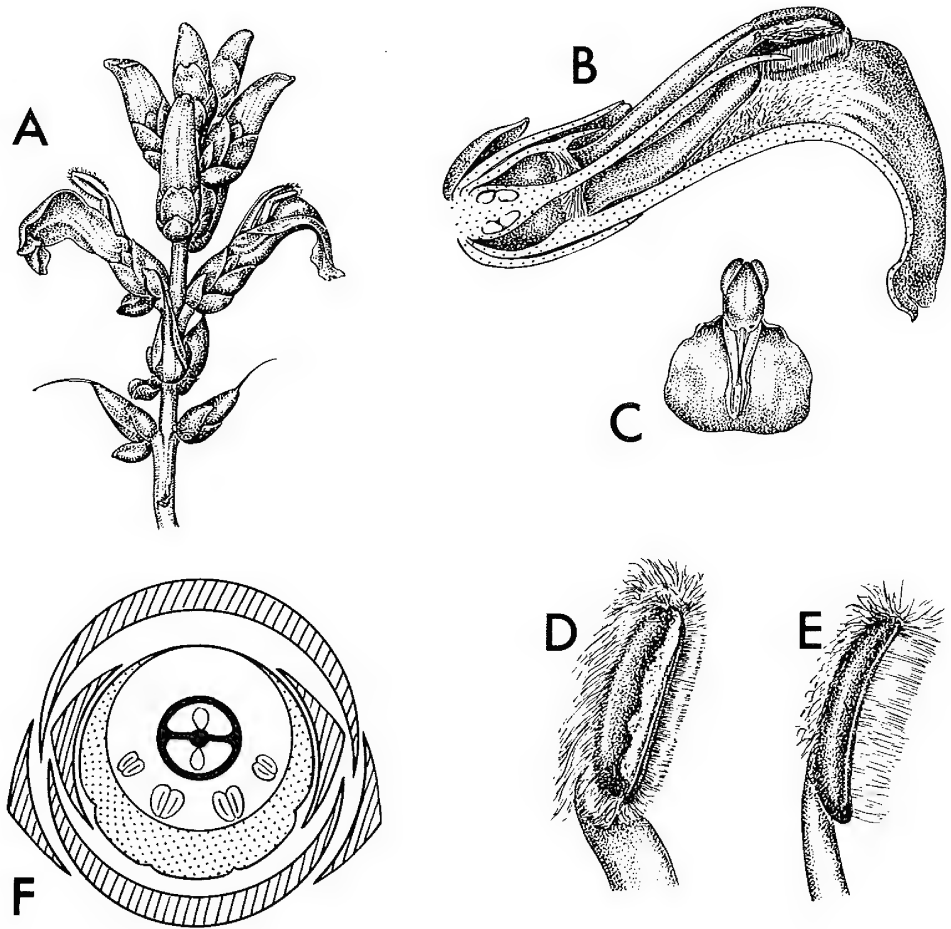
ACANTHUS ILICIFOLIUS L. (ACANTHACEAE)

Acanthus ilicifolius is a shrub or sprawling woody herb with conspicuous blue flowers borne in terminal spikes (Fig. 14A). The corolla is divided into two small upper lobes, and one large recurved lower lip some 35 mm broad and 27 mm long (Fig. 14B, C). The four stamens are in two slightly unequal pairs with their anthers pressed together under tension facing the lower lobe. The anthers (Fig. 14D, E) dehisce longitudinally, with a thick line of hairs lining the split so that pollen is presented on the lower side of the stamens. The stigma rests on top of the anthers, but is prevented by the hairs from coming near the pollen. There is a ring of dense hairs at the base of the stamens where the floral tube narrows (Fig. 14B). All of these hairs point upward and outward, preventing insects from crawling into the floral tube.

A large pollinator visiting the flower probes into the channel about 12 mm long, formed between the stamens and the large corolla lobe below. When the bases of the stamens are touched by the pollinator, they readily diverge in pairs and the style and stigma descend. When pressure on the stamen bases is released, the stigma lifts up and the stamens come back together again. The result is that the stigma touches the back of a pollinator first and picks up pollen, and pollen is deposited by the flower as the pollinator withdraws and the stamens come together again. As a result of this functional morphology, the stigma and the dehiscent anthers rarely contact one another. Self-pollination can occur if the stigma does not return to its original position sufficiently rapidly.

The stigma has two lobes which diverge slightly. On the basis of stigma staining, the stigma does not appear to become receptive until the second day the flower is open. The flowers usually last two days, with exceptional flowers lasting either one or three to four days. Pollen was present in the anthers of all flowers examined, regardless of their age. While the flower morphology tends to prevent the self-pollination of a flower, self-pollination is further restricted by the weak protandry. When pollinator activity is high, all the pollen could be removed from the anthers before the stigma becomes receptive.

The only pollinator seen on a patch of approximately one hundred flowers during six hours of observation was a yellow-breasted sunbird (*Nectarina jugularis*) which perched on the stems and probed in most of the flowers. *Xylocopa* bees, which are also suspected of being pollinators, were seen in the vicinity but did not visit these flowers. The pressure which must be exerted on the stamen bases for them to separate and the distance of the anthers and the stigma from the nectar at the ovary base support the conclusions that pollinators must be relatively large and strong. An examination of inflorescences which had recently finished flowering with a total of several hundred flowers showed that fruits develop from most flowers.



14 *Acanthus ilicifolius*

Figure 14. *Acanthus ilicifolius* L. (from fresh material cultivated at Fairchild Tropical Garden, Miami, Florida). A. Spicate inflorescence (x 2/3). B. Flower (x 2) in longitudinal section. C. Flower (x 2/3) from the front. D. Large stamen (x 4). E. Small stamen (x 4). F. Floral diagram.

Cultivated specimens at Fairchild Tropical Garden, Miami, Florida set rather infrequent seed suggesting a degree of dependence on a fairly generalized pollinator.

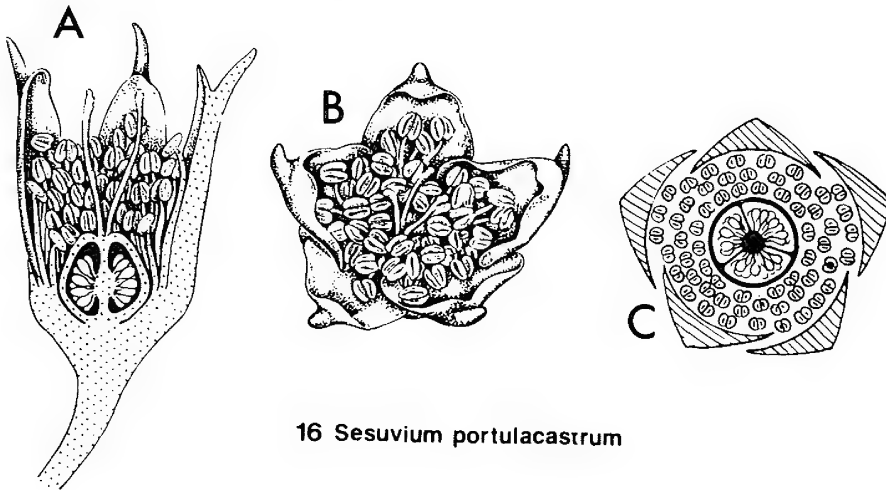
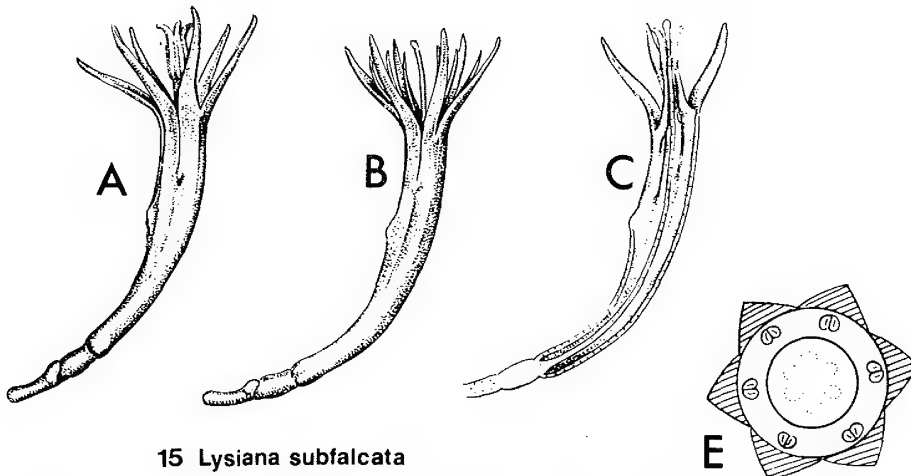
LYSIANA SUBFALCATA (HOOK.) B.A. BARLOW SPP. *MARITIMA* B.A. BARLOW (LORANTHACEAE)

This parasitic epiphyte is confined to mangrove vegetation (Barlow, 1966). The upright flowers are usually produced in two-flowered cymes. The flowers are curved back away from the branch tip (Fig. 15). The petaloid calyx tube is about 25 mm in length and 3.5 mm in width at the mouth with six flaring lobes approximately 10 mm

in length (Fig. 15A, B). The inner, lower two lobes are longer than the others due to the splitting of the calyx lower down producing a slight zygomorphy. The bottom half of the calyx is red below grading into yellowish green above. The six stamens are episealous and bear long, thin anthers covered with sticky, yellow pollen. The ovary is inferior and the stigma is ball-shaped, slightly grooved above and covered with papillae but no discernible ovules are developed, as is usual in the Lorantheae. Since the stigma extends slightly beyond the anthers and the anthers open inward, automatic self-pollination is minimized. There is abundant pollen in the anthers of only

Figure 15. *Lysiana subfalcata* (Hook) B. A. Barlow ssp. *maritima* B. A. Barlow (from fluid-preserved material, Cape Ferguson, Townsville, Queensland). A. Flower (x 4/3) from the side. B. Flower (x 4/3) from the side with stamens removed. C. Flower (x 4/3) in longitudinal section. E. Floral diagram, ovary locules are stylized.

Figure 16. *Sesuvium portulacastrum* L. (from fresh material, Miami, Florida). A. Flower (x 4) in longitudinal section. B. Flower (x 4) from above. C. Floral diagram.



recently open flowers, though some pollen may also persist in older flowers. Flowers last at least three days, and often longer. The stigma becomes receptive as soon as the flower opens and remains receptive as long as the flower persists.

The flowers are visited by several species of nectar-feeding birds, principally a species of honeyeater, probably the white-throated honeyeater (*Melithreptus albogularis*), and also the yellow-breasted sunbird and the mistletoe bird (*Dicquem hirundinaceum*). These birds fly actively between plants, probing all flowers. Many flowers have slits in the calyx tube where the birds have apparently torn the flowers to get at the nectar.

Characters of these flowers related to bird pollination are the inferior ovary for protection against the bird bill, the red calyx as an attractant, and the stickiness of pollen facilitating attachment to the bill of the bird.

Of 83 flower buds and flowers tagged, fifty-six fruit developed; fruit set was 67%.

SESUVIUM PORTULACASTRUM L. (AIZOACEAE)

This prostrate beach herb has a pan-tropical distribution. The flowers (Fig. 16) have five fleshy tepals which are pink on the inside and green on the outside. The tepals open to expose the flower parts, closing again at night and during cloudy weather, but closing finally after the flower has been pollinated. They open again at the time the capsule dehisces. There are about 25-60 stamens, 30 ovules, and 3 (—4) stigmatic lobes per flower. The stamens are pink, and mature progressively from the outside inward during the course of one day; for each stamen, first the filament elongates and then the anther dehisces. The pollen remains in the anther only a brief time as it is rapidly removed by small, pollen-collecting bees (*Trigona hockingsi* Cockerell). The stigma lobes are straight initially and gradually diverge, becoming fully spread after all the anthers have dehisced. Stigma staining shows that the receptive area of the stigma is a narrow strip on the inner surface, beginning at the tip. The stigma does not stain or stains only weakly in newly opened flowers and flowers with most of the anthers at or past dehiscence. Flowers with all the anthers past anthesis and fully divergent stigmas have deeply staining stigmas. The flowers are clearly protandrous, and stay open one to two days. Bees will occasionally probe at the stamen bases of flowers at all stages of development, however, there was no observable nectar present.

Of 29 flowers tagged, nineteen fruits developed; fruit set was 66%.

POLLEN AND OVULE PRODUCTION

The five species span a wide range in ovule production, varying from 4 to 220 ovules per flower. Flowers of *Lysiana subfalcata* do not have differentiated ovules. Pollen production per flower varies from 370 grains in *Clerodendrum inerme* to 588,000 grains in *Sonneratia alba*. Species differ in the pollen-ovule ratios, an index of the efficiency of the pollination system (Cruden, 1977). The pollen/ovule ratios are low in comparison with those calculated for several mangrove species in the Rhizophoraceae (Tomlinson *et al.*, 1978). The pollen/ovule ratio of *Clerodendrum inerme* in particular is low, suggesting that the hawkmoth pollination of this species is highly efficient. The pollen production values for *Lysiana subfalcata*, *Acanthus ilicifolius*, and *Sesuvium portulacastrum* are within the observed range of insect-pollinated species of the Rhizophoraceae, but considerably below the bird-pollinated species of the Rhizophoraceae. The high pollen production and pollen/ovule ratio of *Sonneratia alba* are much higher than expected for a moth-pollinated species; however, this species apparently depends on bats, birds, or wind for pollination in other parts of its range (Backer and van Steenis, 1951).

TABLE 2: Characteristics of five coastal species.

Species	Family	Habit	Typical Habitat	Distribution	Primary Pollinator	Attractant	Floral Tube length (mm)	Flower Color	Ovules Flower	Grains Flower	P/O
<i>Sonneratia alba</i>	Sonneratiaceae	Tree	Seaward mangroves	Old World & Australian tropics	Hawkmoths	Nectar ^a	30 ^b	White	220	588,000	2673
<i>Sesuvium portulacastrum</i>	Aizoa-ceae	Fleshy herb	Sand flats	Cosmopolitan	Small bees	Pollen (nectar)	0	Pink	32	7,500	234
<i>Clerodendrum inerme</i>	Verbenaceae	Sprawling shrub	Beaches mangrove edges	Tropical East Australia	Hawkmoths	Nectar ^a	25	White	4	370	92
<i>Acanthus ilicifolius</i>	Acanthaceae	Small shrub	Landward, sub-canopy in mangroves	Tropical Australasia	Birds, Others?	Nectar	12 ^b	Blue	4	4,500	1125
<i>Lysiana subfal-cata</i> ssp. <i>maritima</i>	Loranthaceae	Parasitic shrub	Epiphyte on mangroves Trees	Tropical E. Australia	Birds	Nectar	38	Red	c	1,470	c

^aindicates that the flower is fragrant ^bdistance from anthers to ovary base ^cindeterminate, no ovules are produced

DISCUSSION

Due to the unstable nature of mangrove and beach vegetation, new areas are constantly being colonized and old habitats destroyed. Initial colonization will often be by a single seed floating in sea water. As a result, mechanisms can be expected which promote out-crossing with its associated genetic advantages, in established populations, but at the same time allow fruit set in isolated individuals. The most important such mechanism in shore line species appears to be protandry, whereby the pollen in a flower is shed before the stigma becomes receptive. Protandry promotes out-crossing by preventing individual flowers from self-pollinating, though flowers on the same plant may pollinate each other. Partial or complete protandry is found in *Sesuvium portulacastrum*, *Clerodendrum inerme*, and *Acanthus ilicifolius*, and in three other common mangrove trees, *Rhizophora stylosa*, *Bruguiera exaristata*, and *Lumnitzera racemosa* (Tomlinson *et al.*, 1978; Tomlinson *et al.*, 1979). While the sample size is not large, the presence of protandry in six out of the eight species studied indicates the importance of protandry as an out-breeding mechanism for coastal associated species.

Morphological adaptations of the flower which prevent self-pollination, generally a physical separation of the anthers and the stigma, are found in *Sonneratia alba*, *Acanthus ilicifolius*, and *Lysiana subfalcata*. Every one of the five species in this study has some obvious mechanism to prevent self-pollination of individual flowers though the flowers are perfect. However, fruit set is 66% or higher in plants of *Sesuvium portulacastrum*, *Sonneratia alba*, *Lysiana subfalcata*, and *Acanthus ilicifolius*. This high fruit set, despite mechanisms which prevent self-pollination in individual flowers, strongly suggests that these plants are self-compatible. Geitonogamy would allow fruit set in isolated colonizing plants. As populations increased to the high density characteristic of many mangrove species, the percentage of fruits resulting from geitonogamous pollinations would decrease as pollen was increasingly transferred between adjacent plants by the pollinators. However, the real measure of degree of out-crossing in coastal species must come from studies of the extent of self-incompatibility. In the present study, visits have been too short to permit the necessary artificial pollination, bagging, and emasculation techniques which are needed to provide unequivocal evidence for out-crossing. This research approach is the next logical step to the results presented here.

There is variation both among species and among populations within species of *Sonneratia* for the presence or absence of petals, the time of day the flowers open, and the color of the petals and stamens. These differences may be adaptations to the local pollinating fauna. Plants with red flowers which open during the day may be adapted to bird pollination, while plants with white flowers which open at night may be adapted to moth or bat pollination.

Adaptations to bird, hawkmoth, and bee pollination were evident in this group of mangrove-associated plant species. This wide range of adaptations is comparable to the divergence in flower types associated with different pollinators found within the mangrove community itself in the Rhizophoraceae (Tomlinson *et al.*, 1979) and the genus *Lumnitzera* (Tomlinson *et al.*, 1978). This research has indicated that each mangrove species shows a distinctive floral morphology and has a particular relationship to the pollinating fauna. These pollination studies only hint at the complexity of animal-plant interactions in tropical coastal communities which will be revealed by further investigation.

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AN ANALYSIS OF THE AUSTRALIAN GRASS FLORA

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Summary

The grass flora of Australia is analysed by several different methods complemented by 6 figures and 15 tables. Native and naturalized exotic entities are given equal treatment and comparisons between the floras of each state are enumerated. Taxonomic breakdowns and comparisons for each state are given at tribal and informal sub-family groupings. Reasons are suggested for the data where possible.

The recently published check-list of Australian grasses (Simon, 1978) provided an incentive to analyse the data in this list along the lines outlined by a recent analysis of the flora of Victoria (Ross, 1976). Although the distributional data in the check-list is given on a state basis, it is realized that a more meaningful analysis would have been obtained had the geographical areas been based on the lines of topography, vegetation types, climate, soils and other general ecological factors as has been recently attempted at generic rank (Clifford & Simon, 1981). However, although political boundaries are in most cases artificial they are unambiguous, and are considered useful demarcations for the present analysis to be undertaken.

The check-list deals only with Australian native and naturalized grasses, although distribution of these grasses into New Guinea was also indicated in the check-list.

TABLE 3: Proportional representation of the grass flora of each state and of Australia.
(Figures shown as native taxa/naturalized exotic taxa).

	Tribes	Genera	Entities
N.S.W.	26(21/5)	149(98/51)	636(418/218)
Vic.	24(19/5)	111(60/51)	382(229/153)
Tas.	21(16/5)	75(35/40)	239(121/118)
N.T.	24(23/1)	99(92/7)	462(419/43)
S.A.	21(17/4)	114(69/45)	352(232/120)
W.A.	24(20/4)	138(91/47)	541(373/168)
Qld.	28(25/3)	155(124/31)	779(610/169)
Australia	33(27/6)	209(148/61)	1299(976/323)

The proportional representation of the grass flora of each state (Table 3) reveals Queensland to have the richest flora at tribal, generic and entity* rank. In terms of the representation of the native flora Queensland again rates highest at tribal, generic and entity rank. The naturalized exotic flora are best represented in New South Wales, Victoria and Tasmania at tribal rank, in New South Wales and Victoria at generic rank and in New South Wales at entity rank. However, in terms of the proportion of naturalized exotics to natives, Tasmania has the highest proportion at tribal, generic and entity rank with the Northern Territory having the lowest. Table 4 shows these proportions in terms of percentage for entities and also shows the percentage of the Australian total for the native and naturalized exotic entities. From the figures it is seen that Queensland is best represented in terms of the native flora and New South Wales in terms of the exotic flora, with Tasmania and the Northern Territory rating last in terms of the native and exotic flora, respectively.

* Throughout this paper the term entity is used to include both species and infra-specific taxa as I consider the placing of a taxon at a particular rank to be arbitrary for the purpose of a broad floristic analysis such as this.

TABLE 4: Percentage of native and naturalized exotic entities in each state, and Australia and percentage of the Australian total of native and naturalized entities for each state.

	% native .	% naturalized	% of Australian natives	% of Australian naturalized exotics
N.S.W.	65.8	34.2	42.7	67.7
Vic.	59.9	40.1	23.4	47.5
Tas.	50.6	49.4	12.4	36.6
N.T.	90.7	9.3	42.8	13.4
S.A.	65.9	34.1	23.7	37.3
W.A.	68.9	31.1	38.1	52.2
Qld.	78.3	21.7	62.4	52.5
Australia	75.2	24.8		

When the density of grasses for each state is examined (Table 5) it is seen there is almost an inverse correlation between size of area under consideration and density, the smaller the area the greater the density. The relationship between area and species number is always of this pattern (Williams, 1964) and a more meaningful interpretation on flora richness is obtained when entity number is plotted against area (Figs 17 and 18), with both the numbers and areas on a logarithmic scale. A straight line of best fit shows the mean measure of 'flora richness' for the whole country and the value for each state can be assessed with relation to this line. Plots are given for both the total (Fig. 17) and native (Fig. 18) floras and from them it can be seen how similar the two graphs are and deduced that when the exotic flora is added to the native flora the richness of the flora is increased proportionately for each state. The one exception is the Northern Territory where the value lies above the mean value for the native grasses but below for all the grasses. This is because of the low number of exotics in the Northern Territory in relation to the relatively high number in the other states. In general Queensland and New South Wales have rich floras relative to their size, Northern Territory, Victoria and Tasmania floras of average richness, and the floras of Western Australia and South Australia are relatively poor. Queensland and New South Wales owe their richness to both states having good seasonal rainfall with the area in common to both (the MacPherson-Macleay the overlap) (Burbidge, 1960) receiving rain at all times of the year. The paucity of the Western Australian and South Australian grass floras is directly correlated to the low average rainfall for each state and the corresponding large areas of desert.

TABLE 5: Density of grass entities for each state and Australia (Figures given for native and for all entities)

	Area (km ²)	No. of entities (Native)	Density (entities/ 10,000 km ²)	No. of entities (All)	Density (entities/ 10,000 km ²)
N.S.W.	804,000	418	5.2	636	7.9
Vic.	227,600	229	10.1	382	16.8
Tas.	67,800	121	17.8	239	35.3
N.T.	1,346,200	419	3.1	462	3.4
S.A.	984,000	232	2.4	352	3.6
W.A.	2,525,500	373	1.5	541	2.1
Qld.	1,727,200	610	3.5	779	4.5
Australia	7,682,300	976	1.3	1299	1.7

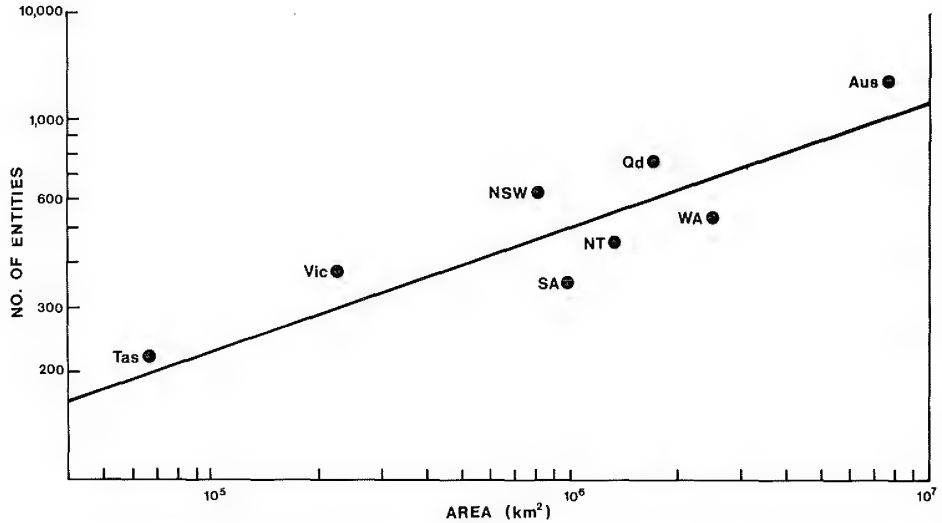


Figure 17 Relation between area and number of entities (native and naturalized exotic), each on a log. scale, in Australian states.

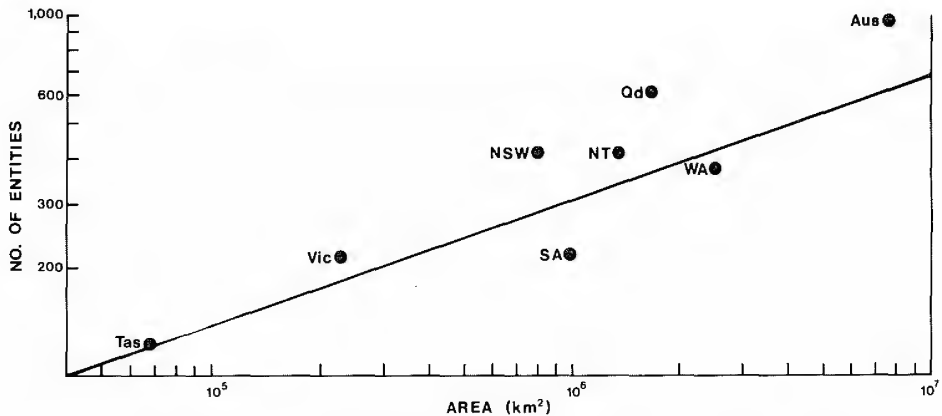


Figure 18. Relation between area and native entities, each on a log. scale, in Australian states.

Tables 6 and 7 show a comparison between the floras of the Australian states with respect to each other, Table 6 giving the number of entities in common between the states and Table 7 transposing these values to a Czekanowski Coefficient of similarity (Czekanowski, 1913). Three values are given in each comparison, one for native entities, one for naturalized exotic entities and one for all entities. Fig. 19 shows the coefficients of the total floras arranged in decreasing order together with the values for the natives and naturalized exotics arranged in the same order. In terms of the total and native values the highest eight values are for states adjacent to each other, six of them being wholly or partially within temperate to subtropical latitudes and two being wholly or partially in tropical latitudes. The high figures for the temperate to subtropical adjacent states are due mainly to the large naturalized exotic component of the floras whereas the high correlation between the adjacent tropical

states (Qld. — N.T.; N.T. — W.A.) can be attributed mainly to the native component. In general the greater the latitude between states the larger the difference between the floras whereas those of a similar latitude show a closer correlation even though they may not have a common border. An example of these two correlations is shown by the low correlation between the Northern Territory and adjacent South Australia compared to the fairly high correlation between non-adjacent Queensland and Western Australia. Another generalization from Fig. 19 is that whenever the native coefficient is above the value for the total flora the naturalized exotic component is below the total value and vice versa.

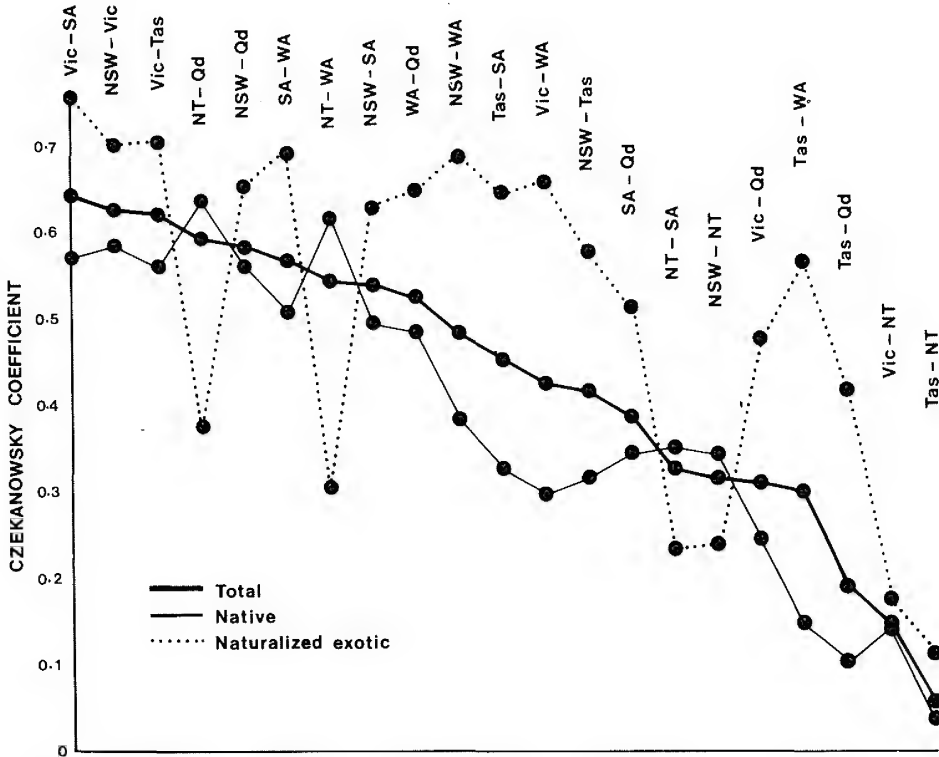


Figure 19. Coefficients of similarity (Czekanowski) of the grass floras of Australian states with respect to each other.

The nature of both endemic and widespread distribution of entities is revealed by the examination of Tables 8 and 9. In terms of total number, Queensland has by far the largest number of endemics due to a large native component and rivals Western Australia in the percentage representation of the total number of endemics*. In terms of the native flora alone however, Western Australia has the highest percentage of endemic entities.

* When the term endemic is applied to naturalized exotic entities endemism is considered only with respect to the geographical areas under consideration in this paper, as an entity being a naturalized exotic naturally implies its native occurrence is geographically outside the area discussed in this paper.

TABLE 6: Number of entities in common between Australian states.

	N.S.W.	Vic.	Tas.	N.T.	S.A.	W.A.
Vict.	188					
	<i>130</i>					
	<u>318</u>					
Tas.	85	98				
	<i>97</i>	<i>95</i>				
	<u>183</u>	<u>193</u>				
N.T.	143	46	10			
	<i>31</i>	<i>17</i>	<i>9</i>			
	<u>174</u>	<u>63</u>	<u>19</u>			
S.A.	161	132	57	114		
	<i>106</i>	<i>103</i>	<i>77</i>	<i>19</i>		
	<u>267</u>	<u>235</u>	<u>134</u>	<u>133</u>		
W.A.	151	90	36	243	154	
	<i>132</i>	<i>105</i>	<i>81</i>	<i>32</i>	<i>100</i>	
	<u>283</u>	<u>195</u>	<u>117</u>	<u>274</u>	<u>254</u>	
Qld.	288	103	38	327	144	237
	<i>126</i>	<i>77</i>	<i>60</i>	<i>40</i>	<i>74</i>	<i>109</i>
	<u>414</u>	<u>180</u>	<u>98</u>	<u>367</u>	<u>218</u>	<u>346</u>

Normal Print = Native

Italic Print = Naturalized Exotic

Underlined Print = Total

When widespread entities are considered (Table 9) only longitudinal spread is examined as it was previously shown there is little merging of the temperate and tropical flora in terms of floristic composition. Widespread entities within temperate Australia are considered with and without the inclusion of Tasmania. It is seen that there is a far higher correlation between the floras of the tropical areas than those of the temperate areas, particularly of the native flora where 21.5 percent of the entities have a widespread distribution in a band across tropical Australia. This contrasts with a low 3.2 percent of the natives being widespread in temperate Australia, including Tasmania. Such a disjunction in the south is due to the Miocene marine incursion in the Nullabor region, whereas no such barrier existed in the north (Laserson, 1955). When the naturalized exotic widespread entities are examined the converse situation exists with 21.1 percent being widespread in the south (over half if Tasmania is excluded) and only 10 percent in the north. This can be attributed directly to man-induced pasture introductions having been far more active in temperate than tropical Australia.

Tables 10 to 13 and Figs 20 to 22 give a taxonomic break-up of the entities for each state and Australia. Tables 10 and 11 deal with the entities grouped into the tribes used in the check-list, Table 10 giving the actual entity number and Table 11 giving the conversion of these numbers to percentages. Due to the conflicting nature of contemporary grass classification at a tribal level (Prat, 1960; Pilger, 1954; Hubbard, 1973) it was thought that graphic representation of taxonomic divisions would

be more meaningful if more loosely defined taxonomic groupings along the lines demarcated by Clifford and Watson (1977) were used. The groupings used differ slightly from those of Clifford and Watson and are given in Table 14. The actual entity number for these groupings are shown in Table 12, with Table 13 giving the percentages and Figs 20 to 22 giving the diagrammatic representation of these percentages.

TABLE 7: Coefficients of similarity (Czekanowski) of the grass floras of Australian states.

	N.S.W.	Vic.	Tas.	N.T.	S.A.	W.A.
Vic.	.581 .700 <u>.625</u>					
Tas.	.315 .577 <u>.416</u>	.560 .701 <u>.622</u>				
N.T.	.342 .238 <u>.317</u>	.142 .174 <u>.149</u>	.037 .112 <u>.054</u>			
S.A.	.495 .627 <u>.541</u>	.573 .755 <u>.640</u>	.323 .647 <u>.454</u>	.350 .233 <u>.327</u>		
W.A.	.382 .684 <u>.481</u>	.299 .654 <u>.423</u>	.146 .566 <u>.300</u>	.614 .303 <u>.548</u>	.509 .694 <u>.569</u>	
Qld.	.560 .651 <u>.585</u>	.245 .478 <u>.310</u>	.104 .418 <u>.192</u>	.635 .377 <u>.591</u>	.342 .512 <u>.385</u>	.482 .647 <u>.524</u>

Normal Print = Native

Italic Print = Naturalized Exotic

Underlined Print = Total

TABLE 8: Endemic entities of each Australian state

	Natives	Naturalized exotics	Total	% Natives	% Naturalized exotics	% Total
N.S.W.	38	28	66	9.1	12.8	10.4
Vic.	7	11	18	3.1	7.2	4.7
Tas.	19	12	31	15.7	10.2	13.0
N.T.	55	1	56	13.1	2.3	12.1
S.A.	16	3	19	6.9	2.5	5.4
W.A.	66	19	85	17.7	11.3	15.7
Qld.	99	23	122	16.2	13.6	15.7

TABLE 9: Widespread entities in Tropical and Temperate Australia

		Natives	Naturalised exotics	Total	% Australian natives	% Australian naturalized exotics
Tropical	W.A. - N.T. - Qld.	210	32	242	21.5	10.0
Temperate	N.S.W. - Vic. - Tas. - S.A. - W.A.	31	68	99	3.2	21.1
	N.S.W. - Vic. - S.A. - W.A.	76	90	166	7.8	51.6

TABLE 10: Numbers of entities in each State and Australia grouped according to tribe. (Figures shown as native entities/naturalized exotic entities).

	N.S.W.	Vic.	Tas.	N.T.	S.A.	W.A.	Qld.	Australia
Agrostideae	59/13	41/15	34/14	1/0	17/12	14/15	16/7	76/21
Andropogoneae	36/10	10/1	4/0	84/4	16/2	56/9	112/14	129/18
Aristideae	31/0	3/0	0/0	31/0	9/0	15/0	61/0	66/0
Arundineae	1/2	1/1	1/2	2/0	2/2	2/2	2/1	2/3
Arundinelleae	1/0	0/0	0/0	2/0	0/0	1/0	4/0	4/0
Aveneae	6/19	5/20	4/16	0/1	3/12	1/18	2/9	8/27
Bambuseae	0/1	0/0	0/0	1/0	0/0	0/0	2/0	3/1
Brachypodieae	0/1	0/1	0/2	0/0	0/1	0/1	0/0	0/2
Bromeae	1/20	1/13	1/9	0/1	1/7	1/7	1/7	1/23
Centosteceae	0/0	0/0	0/0	0/0	0/0	0/0	3/0	3/0
Chlorideae	14/5	5/2	1/0	19/5	10/2	16/4	26/7	30/10
Danthonieae	40/2	33/3	23/1	44/0	27/4	49/4	43/0	107/5
Ehrharteae	0/4	0/4	0/2	0/0	0/4	0/7	0/2	0/8
Eragostideae	45/15	17/4	2/2	90/6	35/7	78/4	103/14	157/13
Garnotieae	0/0	0/0	0/0	0/0	0/0	0/0	1/0	1/0
Isachneae	1/0	1/0	0/0	5/0	1/0	0/0	4/0	5/0
Leptureae	0/0	0/0	0/0	2/0	0/0	0/0	3/0	4/0
Maydeae	1/1	0/0	0/0	2/0	0/0	3/0	3/0	3/1
Melinideae	0/2	0/1	0/0	0/1	0/0	0/2	0/2	0/2
Micraireae	0/0	0/0	0/0	7/0	0/0	0/0	1/0	8/0
Monermeae	0/4	0/4	0/2	0/0	0/4	0/2	0/0	0/5
Nardeae	0/0	0/0	0/1	0/0	0/0	0/0	0/0	0/1
Oryzeae	2/1	0/1	0/0	3/1	0/0	1/1	3/1	4/2
Paniceae	91/60	25/25	5/14	97/20	37/20	73/46	163/68	188/85
Pappophoreae	9/0	2/0	0/0	15/0	8/0	10/0	17/0	20/0
Phalarideae	6/9	8/7	11/7	0/0	2/5	2/8	3/7	15/10
Phareae	0/0	0/0	0/0	0/0	0/0	0/0	1/0	1/0
Poeae	34/31	37/32	18/29	0/2	17/27	12/27	6/20	55/45
Spartineae	0/0	0/2	0/2	0/0	0/1	0/0	0/0	0/3
Sporoboleae	9/2	4/1	1/1	9/0	7/1	6/2	15/3	16/5
Stipeae	24/5	30/3	11/2	3/0	36/1	30/1	8/0	62/5
Triticeae	4/11	3/13	3/12	0/2	1/8	1/8	3/7	4/20
Zoysieae	3/0	3/0	2/0	2/0	3/0	2/0	4/0	4/0
TOTAL	418/218	229/153	121/118	419/43	232/120	373/168	610/169	976/315

TABLE 11: Percentage representation in each State and Australia of the entities (grouped according to tribe), expressed as a percentage of the total for the state or country. (Figures shown as native entities/naturalized exotic entities).

	N.S.W.	Vic.	Tas.	N.T.	S.A.	W.A.	Qld.	Australia
Agrostideae	14.1/6.0	17.9/9.8	28.1/11.9	0.2/0	7.2/10.0	3.8/8.9	2.6/4.1	7.8/6.7
Andropogoneae	8.6/4.6	4.4/0.7	3.3/0	20.0/9.3	6.9/1.7	15.0/5.4	18.4/8.3	13.2/5.7
Aristideae	7.4/0	1.3/0	0/0	7.4/0	3.9/0	4.0/0	10.0/0	6.8/0
Arundineae	0.2/0.9	0.4/0.7	0.8/1.7	0.5/0	0.9/1.7	0.5/1.2	0.3/0.6	0.2/1.0
Arundinelleae	0.2/0	0/0	0/0	0.5/0	0/0	0.3/0	0.7/0	0.4/0
Aveneae	1.4/8.7	2.2/13.1	3.3/13.6	0/2.3	1.3/10.0	0.3/10.7	0.3/5.3	0.8/8.6
Bambuseae	0/0.5	0/0	0/0	0.2/0	0/0	0/0	0.3/0	0.3/0.3
Brachypodieae	0/0.5	0/0.7	0/1.7	0/0	0/0.8	0/0.6	0/0	0/0.6
Bromeae	0.2/9.2	0.4/8.5	0.8/7.6	0/2.3	0.4/5.8	0.3/4.2	0.2/4.1	0.1/7.3
Centosteceae	0/0	0/0	0/0	0/0	0/0	0/0	0.5/0	0.3/0
Chlorideae	3.3/2.3	2.2/1.3	0.8/0	4.5/11.6	4.3/1.7	4.3/2.4	4.3/4.1	3.1/3.2
Danthonieae	9.6/0.9	14.4/2.0	19.0/0.8	10.5/0	11.6/3.3	13.1/2.4	7.1/0	11.0/1.6
Ehrharteae	0/1.8	0/2.6	0/1.7	0/0	0/3.3	0/4.2	0/1.2	0/2.5
Eragrostideae	10.8/6.9	7.4/2.6	1.7/1.7	21.5/14.0	14.7/5.8	20.9/2.4	16.9/8.3	16.1/4.1
Garnotieae	0/0	0/0	0/0	0/0	0/0	0/0	0.2/0	0.1/0
Isachneae	0.2/0	0.4/0	0/0	1.2/0	0.4/0	0/0	0.7/0	0.5/0
Leptureae	0/0	0/0	0/0	0.5/0	0/0	0/0	0.5/0	0.4/0
Maydeae	0.2/0.5	0/0	0/0	0.5/0	0/0	0.8/0	0.5/0.3	0.3/0.3
Melinideae	0/0.9	0/0.7	0/0	0/2.3	0/0	0/1.2	0/1.2	0/0.6
Micraireae	0/0	0/0	0/0	1.7/0	0/0	0/0	0.2/0	0.8/0
Monermeae	0/1.8	0/2.6	0/1.7	0/0	0/3.3	0/1.2	0/0	0/1.6
Nardeae	0/0	0/0	0/0.8	0/0	0/0	0/0	0/0	0/0.3
Oryzeae	0.5/0.5	0/0.7	0/0	0.7/2.3	0/0	0.3/0.6	0.5/0.6	0.4/0.6
Paniceae	21.8/27.5	10.9/16.3	4.1/11.9	23.2/46.5	15.9/16.7	19.6/27.4	26.7/40.2	19.3/27.0
Pappophoreae	2.2/0	0.9/0	0/0	3.6/0	3.5/0	2.7/0	2.8/0	2.1/0
Phalarideae	1.4/4.1	3.5/4.6	9.1/5.9	0/0	0.9/4.2	0.5/4.8	0.5/4.1	1.5/3.2
Phareae	0/0	0/0	0/0	0/0	0/0	0/0	0.2/0	0.1/0
Poeae	8.1/14.2	16.2/20.9	14.9/24.6	0/4.6	7.3/22.5	3.2/16.1	1.0/11.8	5.6/14.3
Spartineae	0/0	0/1.3	0/1.7	0/0	0/0.8	0/0	0/0	0/1.0
Sporoboleae	2.2/0.9	1.7/0.7	0.8/0.8	2.1/0	3.0/0.8	1.6/1.2	2.5/1.8	1.6/1.6
Stipeae	5.7/2.3	13.1/2.0	9.1/1.7	0.7/0	15.5/0.8	8.0/0.6	1.6/0	6.4/1.6
Triticeae	1.0/5.0	1.3/8.5	2.5/10.2	0/4.6	0.4/6.7	0.3/4.8	0.5/4.1	0.4/6.3
Zoysieae	0.7/0	1.3/0	1.7/0	0.5/0	1.3/0	0.5/0	0.7/0	0.4/0
Total	100/100	100/100	100/100	100/100	100/100	100/100	100/100	100/100

In each of the diagrams the taxonomic groupings are placed in the same order starting at a line running due east from the centre of the circle and proceeding segmentally in an anti-clockwise direction in the sequence pooid, andropogonoid, panicoid (strictly eu-panicoid), aristidoid, chloridoid, arundinoid, bambusoid, oryzoid, centostecoid, danthonioid, stipoid, residue. The native and exotic floras will be discussed separately. Within the native floras the pooids, danthonioids and stipoids can be said to represent the temperate element of the flora, and the andropogonoids to centostecoids the tropical element. As would be expected the temperate element becomes better represented the more temperate climate of the state becomes, resulting in a high of almost 85 percent for Tasmania to a low of 11.4 percent for the Northern Territory. Even the latter figure appears too high for a state almost wholly within the tropics but this is due to a placing of *Eriachne* amongst the danthonioids whereas the morphology and phytogeography of this genus suggest its affinities probably lie outside the Danthoneae. The significant temperate representation for Western Australia is due to the south-west corner flora, and for Queensland the flora of portion of the MacPherson-Macleay overlap (Burbidge, 1960).

TABLE 12: Numbers of entities in each state and Australia grouped according to the taxonomic groupings in Table 14
(Figures shown as native entities/naturalized exotic entities).

	N.S.W.	Vic.	Tas.	N.T.	S.A.	W.A.	Qld.	Australia
Pooid	110/108	95/105	71/91	1/6	41/76	31/86	31/57	159/153
Andropogonoid	37/11	10/1	4/0	86/4	16/2	59/9	115/14	132/19
Panicoid	92/62	26/26	5/14	102/21	38/20	73/48	167/70	192/87
Aristidoid	31/0	3/0	0/0	31/0	9/0	15/0	61/0	66/0
Chloridoid	30/22	31/9	6/5	137/11	63/11	112/10	168/24	231/31
Arundinoid	2/2	1/1	1/2	4/0	2/2	3/2	7/1	8/3
Bambusoid	0/1	0/0	0/0	1/0	0/0	0/0	3/0	4/1
Oryzoid	2/1	0/1	0/0	3/1	0/0	1/1	3/1	4/2
Centostecoid	0/0	0/0	0/0	0/0	0/0	0/0	3/0	3/0
Danthonioid	40/2	33/3	23/1	44/0	27/4	49/4	43/0	107/5
Stipoid	24/5	30/3	11/2	3/0	36/1	30/1	8/0	62/5
Residue	0/4	0/4	0/3	7/0	0/4	0/7	1/2	8/9
Total	418/218	229/153	121/118	419/43	232/120	373/168	610/169	976/315

TABLE 13: Percentage representation in each state of the entities (grouped according to the taxonomic groupings in Table 14), expressed as a percentage of the total for the state or country. (Figures shown as entities/native/naturalized exotic entities).

[illegible]

The tropical element will be discussed mainly with reference to the major groups, namely andropogonoids, panicoids, aristidoids and chloridoids. The andropogonoids have their best percentage representation in Northern Territory (20.5 percent), Queensland (18.9 percent) and Western Australia (15.8 percent); these include areas with a monsoon climate (high summer rain, no winter rain), and the first two, having a greater proportion of their territory influenced by a monsoon climate, have the higher figures. These observations concur with those previously stated for species distribution (Hartley, 1958a). The panicoids are best represented in Queensland (27.4 percent), the Northern Territory (24.3 percent), New South Wales (22.0 percent), Western Australia (19.6 percent), and South Australia (16.4 percent). According to Hartley (1958b) this group is best represented at species level in regions of high winter temperatures and high annual rainfall and generally speaking this applies to most of the areas considered. The chloridoids have their best representation in the Northern Territory (32.7 percent), Western Australia (30.0 percent), Queensland (27.6 percent), South Australia (27.2 percent) and New South Wales (19.1 percent) while the aristidoids, which are sometimes linked together with the chloridoids, are best represented in the same states, although in a different order — Queensland (10 percent), Northern Territory (7.4 percent), New South Wales (7.4 percent), Western Australia (4.0 percent), and South Australia (3.9 percent). The distribution of these groups agrees largely with the contention (Hartley and Slater, 1960) that they occur in areas of high aridity, high winter temperatures and summer or non-seasonal rainfall. The Eremean zone, where the chloridoids and aristidoids mainly occur, rates well in all these attributes. The much higher figure for the aristidoids for Queensland than for other states indicates possibly that more species of *Aristida* (the only aristidoid genus) are represented in less arid areas than representatives of the chloridoids in general. The occurrence of certain moisture preferring species of *Aristida* has been shown to exist in South Africa (De Winter, 1965).

When the taxonomic breakup of the exotic flora is examined it is seen that the pooids account for by far the majority of the entities in the temperate states and are even fairly well represented in the tropical states. This results from the high proportion of introductions from Europe since settlement. The panicoids and chloridoids are

TABLE 14: Taxonomic Groupings of Australian Grasses.

Pooid	Agrostideae Aveneae Brachypodieae Bromaeae Monermeae Phalarideae Poeae Triticeae
Andropogonoid	Andropogoneae Maydeae
Panicoid	Isachmeae Melinideae Paniceae
Aristidoid	Aristideae
Chloridoid	Chlorideae Eragrostideae Leptureae Pappophoreae Spartineae Sporoboleae Zoysieae
Arundinoid	Arundineae Arundinelleae Garnotieae
Bambusoid	Bambuseae Phareae
Oryzoid	Oryzeae
Centostecoid	Centosteceae
Danthonioid	Danthonieae
Stipoid	Stipeae
Residue	Ehrharteae Micraireae Nardeae

These groups are basically those of Clifford and Watson (1977) with the following exceptions. 1. *Chionoachne* (Maydeae) is assigned to the andropogonoids from the (eu-) panicoids. 2. *Notochloa*, *Plagiachloa* (*Desmaziera*), and *Spartochloa* (Poeae), *Microlaena* and *Tetrarrhena* (Phalarideae) are assigned to the pooids from the danthonioids and residue respectively. 3. *Plectrachne* and *Triodia* (Eragrostideae) are assigned to the chloridoids from the danthonioids. 4. *Amphipogon*, *Diplopogon*, *Elytrophorus* (Danthonieae) are assigned to the danthonioids from the aristidoids, residue and chloridoids respectively. 5. *Cortaderia* (Arundineae) is assigned to the arundinoids from the danthonioids.

better represented the more tropical the state. Other groupings represented in the states are shown in Figs. 20 to 22.

The genera in Australia with the largest number of entities are listed in order of numerical importance in Table 15, with figures in brackets representing the number of naturalized exotics. If the exotics are taken out the relative positions of some genera are changed somewhat and only 42 of the 56 genera in Table 15 would have 5 or more entities.

TABLE 15: Synopsis of genera with 5 or more entities listed in order of numerical importance.
(Naturalized exotics in brackets)

Eragrostis	71 (13)	Bothriochloa	10 (2)
Aristida	64	Cenchrus	10 (8)
Stipa	63 (3)	Cymbopogon	9
Eriachne	46	Ischaemum	9
Panicum	46 (14)	Echinopogon	9
Poa	45 (7)	Agropyron	9 (7)
Triodia	44	Lolium	9 (9)
Danthonia	38 (1)	Phalaris	9 (9)
Digitaria	38 (8)	Enteropogon	8
Deyeuxia	37	Micraira	8
Agrostis	28 (5)	Ehrharta	8 (8)
Brachiaria	26 (7)	Hordeum	8 (8)
Bromus	24 (23)	Amphibromus	7
Paspalidium	23	Schizachyrium	7
Sorghum	21 (7)	Tetrarrhena	7
Enneapogon	20	Thaumastochloa	7
Sporobolus	20 (4)	Leptochloa	7 (1)
Ectrosia	18	Avena	7 (7)
Iseilema	18	Chrysopogon	6
Setaria	18 (10)	Eriochloa	6
Plectrachne	16	Heterachne	6
Echinochloa	15 (8)	Cynodon	6 (3)
Paspalum	15 (10)	Urochloa	6 (6)
Festuca	14 (5)	Brachyachne	5
Amphipogon	13	Oplismenus	5
Chloris	12 (5)	Hyparrhenia	5 (3)
Pennisetum	12 (9)	Aira	5 (5)
Dichanthium	10 (1)	Vulpia	5 (5)

The tribes with more than one percent of the total number of entities are listed in order of numerical importance in Table 16. The number of genera in these tribes is also shown in the table, but follows no rigid sequence as tribe position is chosen by the numerical order of the entities. The Paniceae is by far the largest tribe with 21 percent of the total followed by the Eragrostideae and the Andropogoneae with 13.8 percent and 11.3 percent respectively. These three tribes comprise just under half (46.1 percent) of the total. If the tribes are arranged in the order of number of genera the sequence is altered significantly with the Eragrostideae falling from second to fourth place and the Poaceae elevated from fifth to third place. The Eragrostideae in fact drop their percentage representation of the total by approximately a half, and this is due to their genera being on average larger than those of the Paniceae and the Andropogoneae. In the Aristideae the figure is 90 percent smaller due to there being only one genus *Aristida* with a large number of species.

Table 17 shows the proportion of native entities to naturalized exotic entities for those tribes with more than one percent of the total number of entities. The tribes are listed in order of the numerical importance of native entities. The sequence of tribes

considering only natives is similar to the sequence of tribes when natives and exotics are considered together (Table 16) for the first four tribes but the sequence after that differs somewhat. The Poeae fall from fifth to eighth position because of the high number of naturalized entities. Three tribes — the Aristideae, the Pappophoreae and the Micraireae are represented only by native entities and four others — the Eragrostideae, the Andropogoneae, the Danthonieae and the Stipeae have more than 85 percent of their totals represented by natives. In contrast, three tribes (Aveneae — 78.4 percent, Triticaceae — 83.3 percent, Bromeae — 96 percent) are represented by high proportions of exotic entities.

TABLE 16: Synopsis of the tribes whose entities, both native and naturalized exotic, comprise more than 1 percent of the total number, listed in order of numerical importance, together with the number of genera in each tribe.

TRIBE	NO. OF ENTITIES	PERCENT ENTITIES	NO. OF GENERA	PERCENT GENERA
Panicaceae	272	21.0	41	19.5
Eragrostideae	175	13.5	15	7.1
Andropogoneae	147	11.3	37	17.6
Danthonieae	112	8.6	13	6.2
Poeae	100	7.7	17	8.1
Agrostideae	98	7.5	14	6.7
Stipeae	66	5.1	4	1.9
Aristideae	64	4.9	1	0.5
Chlorideae	40	3.1	9	4.3
Aveneae	37	2.9	12	5.7
Phalarideae	25	1.9	5	2.4
Triticaceae	24	1.8	5	2.4
Bromeae	24	1.8	1	0.5
Sporoboleae	21	1.6	2	1.0
Pappophoreae	20	1.5	1	0.5

TABLE 17: Synopsis of the tribes with more than 1 percent of the total number of entities showing the proportion of native and naturalized exotic entities within each tribe, the tribes listed in order of numerical importance of the native entities.

TRIBE	NO. OF NATIVE ENTITIES	PERCENT NATIVE ENTITIES	NO. OF NATURALIZED EXOTIC ENTITIES	PERCENT OF NATURALIZED EXOTIC ENTITIES
Panicaceae	187	68.8	85	31.2
Eragrostideae	154	88.0	21	12.0
Andropogoneae	130	88.4	17	11.6
Danthonieae	107	95.5	5	4.5
Agrostideae	76	77.6	22	22.4
Aristideae	64	100.0	0	0.0
Stipeae	61	92.4	5	7.6
Poeae	55	55.0	45	45.0
Chlorideae	30	75.0	10	25.0
Pappophoreae	20	100.0	0	0.0
Sporoboleae	16	76.2	5	23.8
Phalarideae	15	60.0	10	40.0
Aveneae	8	21.6	29	78.4
Micraireae	8	100.0	0	0.0
Triticaceae	4	16.7	20	83.3
Bromeae	1	4.0	23	96.0

Records are being constantly added to and corrections made to the Australian check-list and since publication a few pages of addenda and corrigenda have accumulated. However, the figures given in this analysis strictly pertain to the contents of the list as published and as such they are, following the check-list, of a preliminary nature and will be updated when the taxonomy has been more thoroughly researched.

Acknowledgments

I extend my grateful thanks to Dr. R.W. Johnson, Director, Botany Branch, for his ever ready assistance in formulating FORTRAN programmes used in the analysis of data. I am also most grateful to Mr. K.M. Rosenthal of Development Planning Branch for FORTRAN assistance given in the compilation of Figs 20 to 22.

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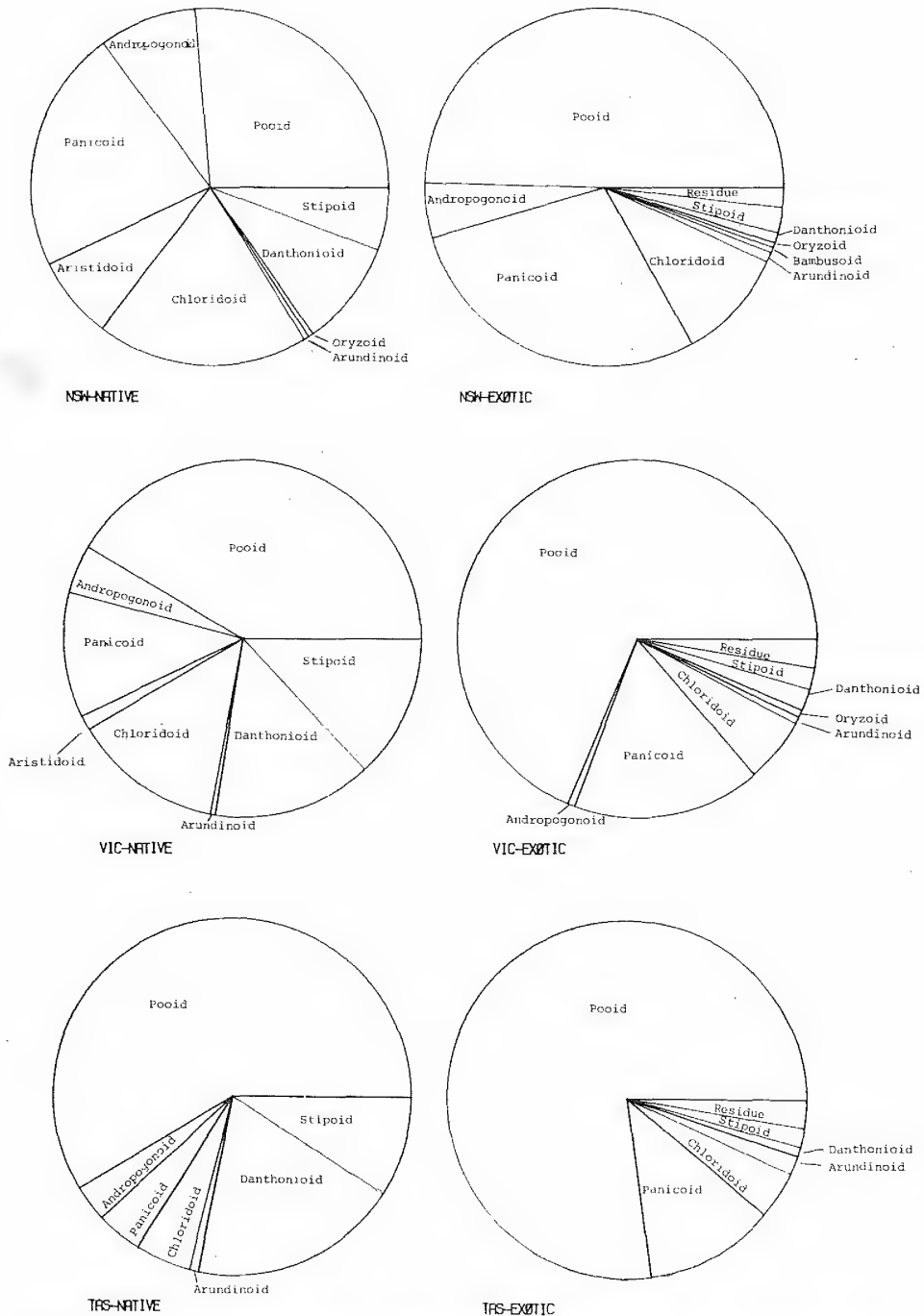


Figure 20. Proportional representation of native and naturalized exotic taxonomic groupings of grasses for New South Wales, Victoria and Tasmania.

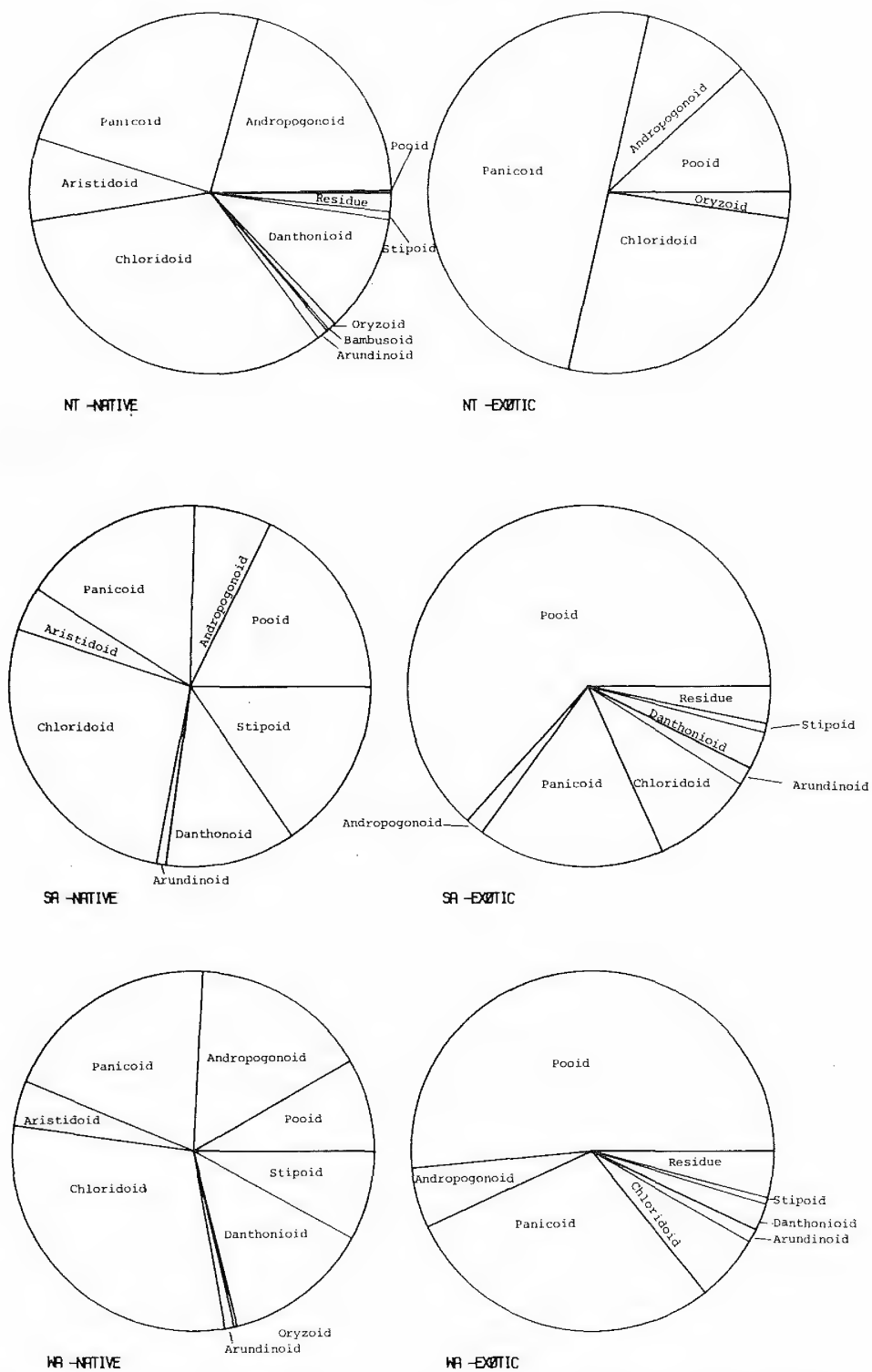


Figure 21. Proportional representation of native and naturalized exotic taxonomic groupings of grasses for Northern Territory, South Australia and Western Australia.

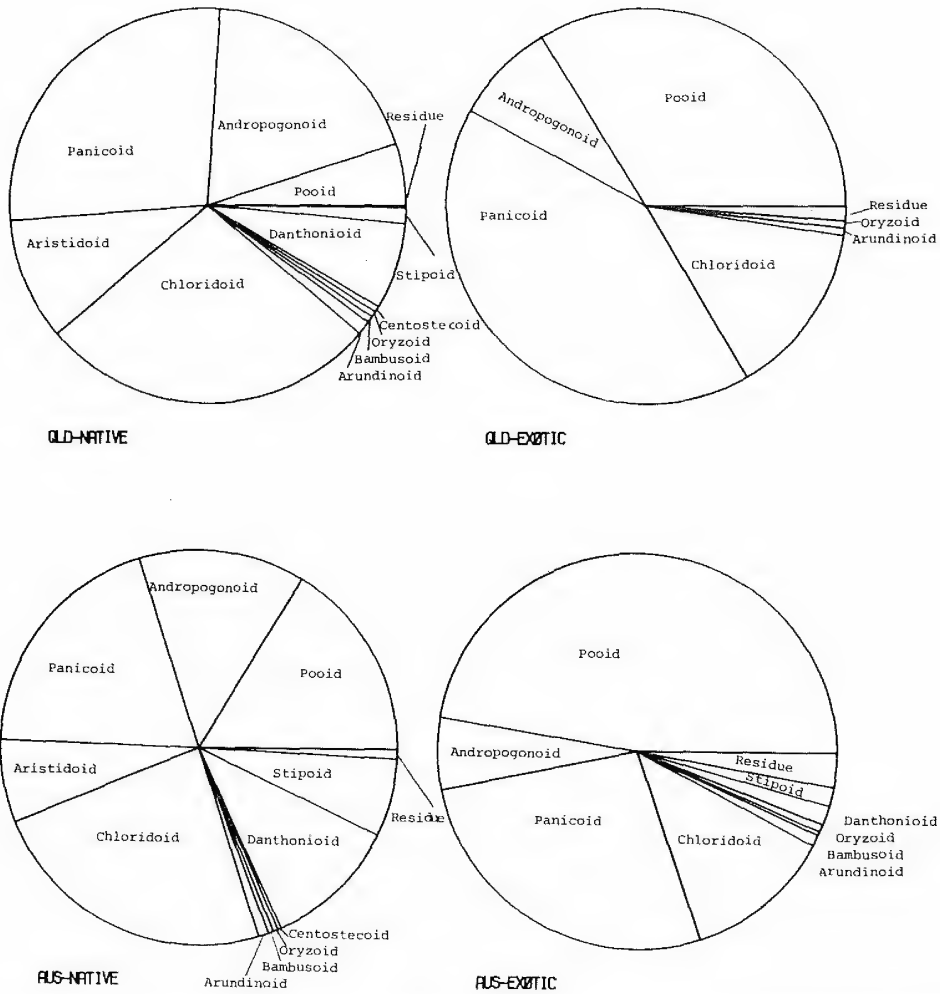


Figure 22. Proportional representation of native and naturalized exotic taxonomic groupings of grasses for Queensland and Australia.

NOTES ON THE GENUS HOMORANTHUS (MYRTACEAE) IN AUSTRALIA

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Summary

Three new species of *Homoranthus*, *H. papillatus*, *H. decasetus* and *H. tropicus* are described and a key to the species in the genus is given. Notes on the salient characteristics of the genus and each species with some notes on distribution are included.

The genus *Homoranthus* is not a clearly defined natural group but is more a genus of convenience intermediate between *Darwinia* and *Verticordia*. This was first discussed by Bentham (1869) when in the section on *Homoranthus* in his notes on Myrtaceae he stated "Its retention may, however, be justified as facilitating the distinction between *Darwinia* and *Verticordia*."

Cheel (1922) discussed the status of *Darwinia*, *Homoranthus*, *Rylstonea* and *Verticordia* giving the history of the origin of each of the genera and morphology of the groups. As a result of this study he united the genus *Rylstonea* with *Homoranthus* and transferred two species of *Verticordia* (*V. darwinioides* and *V. wilhelmii*) to *Homoranthus*. This transfer of species enabled a more natural separation of *Verticordia* from *Darwinia* and *Homoranthus* based on calyx shape.

Since Cheel's paper no one has advanced a more precise segregation of the genera. Chromosome numbers for three species of *Homoranthus* are given as $n = 9$ by Smith-White (1954) in a paper which included the same haploid number for some species of *Verticordia* and *Darwinia*.

Two of the three species described here under *Homoranthus* are additional examples in the continuum between *Darwinia* and *Verticordia* particularly in respect of the appendages of the calyx lobes.

With the study of additional species to be referred to *Homoranthus* in this paper, the characters found most useful for separating the genera are given in the following key.

Calyx tube hemispherical, lobes deeply divided into subulate, plumose or ciliate processes. . . . *Verticordia*
Calyx tube cylindrical or urceolate, each lobe with a single subulate process or digitately divided into 2–10 processes. . . . *Homoranthus*
Calyx tube cylindrical, lobes broad, entire or shortly ciliate. . . . *Darwinia*

Homoranthus Cunn. ex Schau.

Shrubs erect or spreading. Leaves opposite, shortly petiolate or almost sessile, linear, triangular or terete, usually laterally compressed. Inflorescences various. Bracts usually similar to leaves but commonly smaller, sometimes scale-like. Bracteoles 2, concave, sometimes with a keel ending in a short point. Floral tube cylindrical or urceolate, the lower part adnate to the ovary and with 5 distinct longitudinal ridges, upper part free, thin, usually smooth, persistent. Calyx lobes 5, with 1–10 elongated processes on each lobe. Petals 5, entire. Stamens 10; filaments linear; anthers globular, dehiscing by pores. Staminodes 10, alternating with stamens. Style exceeding the perianth, bearing a ring of hairs below the apex. Ovary unilocular with 2–10 ovules borne on a basal placenta.

Type species. *H. virgatus* Cunn. ex Schau. Bentham in effect nominated this as the type species when he reduced the genus to a single species in Fl. Aust. 3:16 (1869).

- 1a Calyx with two elongated hair-like processes on each lobe..... 4. *H. decasetus*
- 1b Calyx with only one elongated hair-like process on each lobe..... 2
- 1c Calyx with 3-10 elongated hairlike processes on each lobe..... 4
 - 2a Leaves densely covered with very short trichomes..... 3. *H. papillatus*
 - 2b Leaves glabrous..... 3
- 3a Style exceeding petals by more than 4 mm; shrub usually spreading..... 2. *H. flavescens*
- 3b Style exceeding petals by less than 3 mm; shrub erect..... 1. *H. virgatus*
 - 4a Flowers borne in pairs on axillary peduncles..... 5. *H. darwinoides*
 - 4b Flowers borne in leafy racemes, heads or panicles..... 5
- 5a Hair-like processes 3-6 on each calyx lobes; petals ovate..... 6. *H. wilhelmii*
- 5b Hair-like processes 5-10 on each calyx lobe; petals broadly obovate or orbicular..... 7. *H. tropicus*

1. *Homoranthus virgatus* Cunn ex Schau., Myrt. Xeroc. 41 (1842).

Although Bentham (1866) combined this species with *H. flavescens*, the two are distinct entities and grow in different habitats. *H. virgatus* is an erect virgate shrub with leaves not as conspicuously punctate as *H. flavescens* and the flowers have shorter styles.

This species is usually confined in its distribution to the sandstone, sandhills or "wallum" complexes along the coastal fringe from Shoalwater Bay, Queensland to Taree, New South Wales. One collection (*Hando* 114) is from Gurulmundi, Darling Downs district.

2. *Homoranthus flavescens* Cunn. ex Schau., Myrt. Xeroc. 40 (1842).

In habit the species occurs as a spreading glaucous shrubs rarely erect often attaining a diameter exceeding 1 m yet being less than 40 cms high. It is found in a variety of soils on the western slopes of the Great Dividing Range from near Chinchilla, Queensland to the Liverpool Range in New South Wales.

3. *Homoranthus papillatus* N. Byrnes sp. nov. affinis *H. virgato* Cunn. ex Schau. et *H. flavesci* Cunn. ex Schau. sed foliis papillatis differt. **Typus:** McDonald 1623.

Frutex compactus, ad 2 m altus. Folia opposita, petiolis brevissimis, linearia, falcata, trigona, 0.6-1.2 cm longa, ca 1 mm lata et crassa, acuta vel acuminata, glauca, punctata (plerumque obscura); epidermis papillata. Flores solitarii in axillis superas foliorum in pedicellos 1-2 mm longos. Bracteolae alabastrum includentes, ad 5 mm longae, scariosae, caducae. Calycis tubus 4 mm longus, 1 mm diam., glaber, nitidus, laevis, manifeste 5-costatus. Calycis lobi subulati, ad 3 mm longi. Petala orbiculata, ca 1 mm diam. Stamina 10, filamentis ca 0.5 mm longis. Staminodia 10, ca 0.5 mm longa. Stylus 6-9 mm longus. Ovarium uniloculare, placentione basilari, ovulis 8-10. Fructus siccus, flori similis, seminis 1-2 alatis.

Shrub compact to 2 m high. Leaves opposite, very shortly petiolate, linear, falcate, trigonous, 0.6-1.2 cm long, about 1 mm wide and **thick**, acute or acuminate, punctate (sometimes obscure) with a papillate epidermis. **Flowers** solitary in the upper leaf axils on pedicels 1-2 mm long. Bracteoles enclosing the flower buds, to 5 mm long, scarious, caducous. Calyx tube 4 mm long, 1 mm diam, glabrous, shiny, smooth, distinctly 5-ribbed. Calyx lobes subulate to 3 mm long. Petals orbicular, about 1 mm diam. Stamens 10 with filaments about 0.5 mm long. Staminodes 10 about 0.5 mm long. Style 6-9 mm long. Ovary unilocular containing 8-10 ovules borne on a basal placenta. Fruit dry, similar to the flower containing 1-2 winged seeds.

Queensland. DARLING DOWNS DISTRICT: Mt Norman, Girraween National Park, Sep 1976, *McDonald* 1623 (holo, BRI; iso, CANB, K, NSW, L, MEL); Nov 1944, *Clemens* (BRI), Oct 1959, *Henderson* (BRI), Jun 1962, Sep 1963, Dec 1970, *Hockings* (BRI), Oct 1970, *Ryan* (BRI), Nov 1971, *Blake* 23712 (BRI), Sep 1975, *Stanley and Sharpe* (BRI).

Range. This species apparently has a very restricted range as all collections and sightings of the plant have been in the Girraween National Park area.

Habitat. This plant occurs in shallow gritty soils in crevices and flat areas among granite boulders.

Its restricted range and its similarity to *H. virgatus* and *H. flavescens* has contributed to this species being overlooked till quite recently. The outer walls of the cells of the epidermis of leaves, pedicels and branches are raised into projections of various shapes, mostly as very short hairs. These projections are dense and can readily be seen with the aid of a lens. These structures enable this species to be recognised even when sterile. In addition, plants of *H. papillatus* are usually more compact and glaucous than other members of the genus.

4. *Homoranthus decasetus* N. Byrnes sp. nov. affinis *H. virgato* Cunn. ex Schau. sed tubo calycis urceolata et lobis calycis differt. **Typus: Olsen and Byrnes 3546.**

Frutex ad 2 m altus. Folia opposita breviter petiolata, clavata, teretia, falcata, breviter apiculata, ad 12 mm longa, ca 1 mm lata, punctata. Flores unici ad apicem ramulorum axillarium brevium. Bracteolae caducae, alabastrum juvenam includentes, ad 3 mm longae, carina in acumen distinctum desinens. Tubus calycis urceolatus, costis 5 prominentibus infra medium. Lobi calycis unusquisque 2 (raro 3) processibus subulatis ad 4 mm longis. Petala orbicularia, ca 2 mm diam. Stamina et staminodia uterque 10; alternantia ca 1 mm longa prope basin connata, affixa ad calycem ad basim. Stylus 14–18 mm longus. Ovarium ca 2 mm longum, uniloculare, placenta secunda, ovulis 8. Fructus siccus, flori simili sed leviter grandioris, semine solitario alato.

Shrub to 2 m high. Leaves opposite, shortly petiolate, clavate, terete, falcate, shortly apiculate, to 12 mm long, about 1 mm wide, punctate (barely visible to naked eye). Flowers solitary at the tips of short axillary branches. Bracteoles to 3 mm long enclosing the young flower buds and each with a keel ending in a short point, caducous. Calyx tube urceolate, strongly 5 ribbed below the middle. Calyx lobes each with 2 (rarely 3) subulate processes to 4 mm long. Petals orbicular, about 2 mm diam. Stamens and staminodes 10 of each, alternating, about 1 mm long, connate below and attached to the base of the calyx lobes. Style 14–18 mm long. Ovary about 2 mm long, unilocular with 8 ovules on a secund placenta. Fruit dry, similar to the flower but slightly enlarged and containing a single winged seed.

Queensland. LEICHHARDT DISTRICT: Isla Gorge, May 1977, Olsen and Byrnes 3547 & 3546 (holo, BRI; iso, CANB, NSW, Mel, K, P), Sep 1968, Everist 8037 (BRI), Apr 1971, Hockings (BRI).

Range. This species is apparently confined to Isla Gorge and its vicinity.

Habitat. The plants are found on shallow soils in areas of dissected sandstone.

The flowers of this species are distinct from those of other members of the genus by being noticeably constricted above the middle, having two processes on each calyx lobe and by being borne singly and erectly at the end of short branchlets. Exposure to direct sunlight causes the flowers to change from white to red.

5. *Homoranthus darwinioides* (Maiden & Betcher) Cheal, Proc. Linn. Soc. N.S.W. 54:77 (1922).

Verticordia darwinioides Maiden & Betcher, J. Linn. Soc. N.S.W. 3:17 (1898).

Rylstonea cernua R.T. Baker, J. Linn. Soc. N.S.W. 3:768 (1898).

This species occurs as a slender glabrous shrub characterised by its distinctive pendulous inflorescences, each consisting of two flowers on an axillary peduncle. The bracteoles are more persistent in this species than those of other members of the genus.

It has been collected on the Great Dividing Range and Central Western Slopes of NSW between Putty and Dubbo.

6. *Homoranthus wilhelmii* (F. Muell.) Cheel, Proc. Linn. Soc. N.S.W. 54:77 (1922).
Verticordia wilhelmii F. Muell. Trans. Vic. Inst. 122 (1855).

This species occurs as a slender erect shrub with dense terminal leafy corymbs. Each calyx lobes has 3–6 (usually 5) setae. It is restricted to the area from the southern part of Eyre Peninsula to Streaky Bay in South Australia.

7. *Homoranthus tropicus* N. Byrnes sp. nov. affinis *H. wilhelmii* (F. Muell.) Cheel sed petalo late obovato et sepalis ferentes plus projecturas differt. **Typus:** Byrnes 3359.

Frutex ad 1 m altus. Folia opposita, lateraliter compressa, clavata, falcata, apiculata, basi petiolo breve angustata, 4–8 mm longa, ca 0.5 mm lata, punctata. Flores albi, axillares in pedicellos 0.5–1.5 mm longos. Bracteolae 1–1.5 mm longae, carina in acumen breve desinens, caducae. Tubus calycis ad 4 mm longus distincte 5-angulatus. Lobi calycis palmati projecturis 5–10 longis et angustis. Petala integra, late obovata vel fere circulares; ca 2 mm longa. Stamina et staminodi 2–3 mm longa, per ultra $\frac{2}{3}$ longitudinalis in tubum connata. Stylus ad 7 mm longus, tomentellus apicem versus. Ovarium uniloculare, placentae basalis ovulis 8–10 ad latus unum affixa. Fructus in calyce leviter acto contentus, semine solitario globoso.

Shrub to 1 m high. Leaves opposite, laterally compressed, clavate, falcate, apiculate, at the base tapering into a short petiole, 4–8 mm long, about 0.5 mm wide, punctate. Flowers white, on pedicels 0.5–1.5 mm long. Bracteoles 1–1.5 mm long, each with a keel ending in a short point, caducous. Calyx tube to 4 mm long with five distinct angles. Calyx lobes 3–4 mm long, palmately lobed, each with 5–10 long narrow projections. Petals entire, broadly obovate to nearly circular about 2 mm long. Stamens and staminodes 2–3 mm long, fused into a tube for more than $\frac{2}{3}$ of their length. Style to 7 mm long with minute stiff hairs below the apex. Ovary unilocular containing 8–10 ovules borne on one side of a basal placenta. Fruit contained in the slightly enlarged calyx, with a single spherical seed.

Queensland. COOK DISTRICT: Laura sandstone area north of Laura R. near Early Man site, May 1975, Byrnes 3359 (holo, BRI; iso, CANB, K, NSW); near Laura R., Aug 1974, Byrnes 3078 (BRI); 10 miles from Laura towards Lakeland Downs, Jun 1972, Wrigley and Telford NQ 1470 (NSW); Garden Ck (Little Laura R.), Feb 1978, Hinton 89 (BRI).

Range. This species is represented by only four collections all from sandstone areas near Laura. Further collections are likely to be made from other sites in the extensive sandstone formations in this area.

Habitat. This species grows in shallow sandy soils in areas near cliffs and on eroded creek banks.

Of all the species of *Homoranthus*, *H. tropicus* has the largest number of setae on the calyx lobes. This character associated with the broader petals are the principal differences between this species and the closely related *H. wilhelmii*.

H. tropicus is not common in the area from where collections have been made.

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NOTES ON LEGUMINOSAE. II.

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Summary

Abarema sapindoides (Cunn. ex Sweet) Kosterm. is an illegitimate name. Its correct name is *Pithecellobium pruinatum* Cunn. ex Benth. The species of *Pithecellobium* that occur in Queensland are enumerated.

The number of ovules does not clearly distinguish *Atylosia* Wight & Arn. from *Rhynchosia* Lour. The two genera are redefined in terms of presence or absence of a rim-aril and of a septate pod. *Nomismia* Wight & Arn. is recognised to include species not referable to the other two genera. The combination *Nomismia rhomboidea* based on *Rhynchosia rhomboidea* F. Muell. ex Benth. is made.

Mirbelia viminalis (Cunn. ex Benth.) C.A. Gardner is recorded from Queensland.

MIMOSOIDEAE

PITHECELLOBIUM MART.

In recent years many authors (for example, Beadle *et al.* (1972), Beadle (1976)) have followed Kostermans (1954) in referring Australian species previously referred to *Pithecellobium* to *Abarema* Pittier. While examining these species for the forthcoming "Handbook to the Flora of South-eastern Queensland" I found that there were unsolved taxonomic and nomenclatural problems, particularly in *Pithecellobium pruinatum*.

Abarema sapindoides (Cunn. ex Sweet) Kosterm., a name in general use, is based on *Acacia sapindoides* Cunn. ex Sweet which is a name without description and therefore invalid. The first validly published name for the species seems to be *Pithecellobium pruinatum* Benth., which has never been correctly transferred to *Abarema*. In the light of recent taxonomic work such a transfer is not now warranted.

Nielsen (1979) critically examined generic limits of the Asian Ingeae. The genera he recognized are broader than those recognized by Kostermans (op. cit.) but narrower than those of Bentham (1875). He stated that he "followed an intermediate course in referring the Asian-Malesian Ingeae with opposite leaflets, uniform flowers, seeds without aril and pleurogram to the genus *Archidendron* whereas the *Ingeae* with opposite leaflets, flowers in heads, heteromorphic flowers . . . , seeds without aril but with pleurogram are referred to the genus *Albizia*". As *Abarema trapezifolia* (Vahl) Pittier, the lectotype of *Abarema* (Cowan 1959), has dimorphic flowers, Nielsen considered that Old World species of *Pithecellobium* referred to *Abarema* by Kostermans had been wrongly placed. Most of them will have to be transferred to *Archidendron*.

Pithecellobium pruinatum Benth. has however some unusual features. Its leaflets are alternately arranged along the rachilla and at the base of each there is a small but conspicuous gland. Its seeds have a pleurogram. The latter character would exclude it from *Archidendron* as Nielsen defined it but he (in litt. 1979) stated: "*Pithecellobium pruinatum* is causing . . . some trouble But it will probably go to *Archidendron*".

It would be inappropriate to describe new taxa or to make new combinations until Nielsen's work is finished. The following species occurring in south-eastern Queensland are therefore retained in *Pithecellobium*.

Pithecellobium grandiflorum Sol. ex Benth., Fl. Aust. 2:424 (1864).

P. tozeri F. Muell., Fragm. Phytog. Aust. 5:10 (1865).

Albizia tozeri (F. Muell.) F. Muell., Trimen J. Bot. 10:10 (1872).

Abarema grandiflora (Sol. ex Benth.) Kosterm., Organiz. Scient. Res. Indonesia Bull. 20:34 (1954).

Pithecellobium hendersonii F. Muell., Fragm. Phytog. Aust. 5:191 (1866).

Albizia hendersonii (F. Muell.) F. Muell., Trimen J. Bot. 10:10 (1872).

Abarema hendersonii (F. Muell.) Kosterm., Organiz. Scient. Res. Indonesia Bull. 20:34 (1954).

Pithecellobium lovelliae F.M. Bailey, Qd Dept. Ag. Bot. Bull. 8:74 (1893).

Abarema lovelliae (F.M. Bailey) Kosterm., Organiz. Scient. Res. Indonesia Bull. 20:35 (1954).

Pithecellobium muelleranum (Maiden & R.T. Baker) Maiden & Betche, Census N.S.W. Plants 89 (1916).

Albizia muellerana Maiden & R.T. Baker, Proc. Linn. Soc. N.S.W. 10 (2nd ser.):585 (1896).

Abarema muellerana (Maiden & R.T. Baker) Kosterm., Adansonia 6:369 (1966).

Maiden & Baker accepted Mueller's broad concept of *Albizia* and described *P. muelleranum* as an *Albizia*. Maiden & Betche appear to have been the first to refer the species to *Pithecellobium*.

Pithecellobium pruinoseum Cunn. ex Benth., London J. Bot. 3:211 (1844).

Acacia sapindoides Cunn. ex Sweet, Hort. Brit. ed 3. 198 (1839), *nomen*.

Pithecellobium sapindoides Domin, Biblioth. Bot. 89:276 (1926).

Abarema sapindoides Kosterm., Organiz. Scient. Res. Indonesia Bull. 20:38 (1954).

Abarema pruinosa K.A.W. Williams, Native Plants of Queensland (1979) *nom. invalidum*.

Williams who was aware of the problems associated with *P. pruinoseum* was advised to use the name *Abarema pruinosa* in anticipation of the combination being made. Nielsen's work has made the combination unnecessary, but his results were published too late for Williams to alter the name.

PAPILIONOIDEAE

ATYLOSIA WIGHT & ARN.

While revising species of *Atylosia* in Australia (Reynolds & Pedley 1980) it became evident that limits of the genera of the tribe Cajaneae (Hutchinson 1964) were not well defined. The problem is not restricted to Australia, but a solution applicable to Australia taxa only was sought. Its application to a wider geographic area will have to be tested by workers on the Asian and African floras.

Atylosia, a genus of about 35 species (Hutchinson *op. cit.*) is usually distinguished in keys from the more widely ranging and larger genus *Rhynchosia* Lour. (ca 200 species, Gillett *et al.* 1971) by the number of ovules: *Rhynchosia* 2 (rarely 1), *Atylosia* 4 or more (Bentham & Hooker 1865, Merrill 1910, Hutchinson *op. cit.*, Gillett *et al.*, *op. cit.*). Hutchinson placed *Atylosia* under "ovules 4 or more" in his key but he described it as having 3-many ovules. Bentham (1864) recognised the close affinity of the two genera as can be seen by his notes to *Atylosia marmorata* Benth., *A. scarabaeoides* (L.) Benth. and *Rhynchosia acutifolia* F. Muell. ex Benth.

Though there is difficulty in separating some Australian species of *Rhynchosia* from species of *Atylosia*, *R. volubilis* Lour. (the type species) and *A. trinervia* (DC.)

Gamble (*A. candollei* Wight & Arn., the lectotype species) do appear to belong to different genera. The number of ovules is an unsatisfactory character for distinguishing the genera, but attributes of pods and seeds seem to provide more satisfactory distinctions. If characters of pods and seeds are used to distinguish the genera then the taxonomy of Wight and Arnott proves to be reasonably acceptable and the names of only a few species will be affected.

The genera can be redefined as follows:

Rhynchosia Lour. Type species: *R. volubilis* Lour.

Ovules (1—)2; pods (1—)2-seeded without a partition between the seeds, valves without distinct transverse reticulate veins; seeds without a distinct fleshy rim aril.

Atylosia Wight & Arn. Lectotype species: *A. trinervia* (DC.) Gamble

Ovules 2—many; pods 2—many-seeded with distinct partitions between the seeds, and valves with transverse or oblique lines, but not reticulate veins; seeds with a fleshy rim aril.

When *Atylosia* is defined in this way then *Rhynchosia* subgenus *Phyllomata* Wight & Arn. and *Rhynchosia* subgenus *Ptychocentrum* Wight & Arn., both with only a few species, must be referred to *Atylosia*.

A few species have seeds with thick rim-arils but their pods do not have septa between the seeds. In characters of seeds and pods they are somewhat intermediate between *Atylosia* and *Rhynchosia*. Their pods, unlike those of *Atylosia* and *Rhynchosia*, are strongly transversely veined and they may be referred to *Nomismia* Wight & Arn.

Nomismia Wight & Arn. Lectotype species: *N. nummularia* Wight & Arn.

Ovules 1—2; pods compressed, \pm orbicular, 1—2-seeded strongly transversely veined; seeds with a large fleshy rim aril.

Though the pods of *Atylosia platycarpa* has pods described as transversely reticulate they are distinctly depressed between the seeds and it and other species of *Atylosia* section *Rhynchosioides* should remain in *Atylosia*. The position of other species is less certain. *Rhynchosia monophylla* Schlecht. which was referred to *Rhynchosia* section *Nomismia* by Gillett *et al.* has a distinct rim aril but its pod is like that of *Rhynchosia* rather than either *Nomismia* or *Atylosia*.

The redefinition of *Atylosia* and *Rhynchosia* results in the transfer of *Rhynchosia acutifolia* F. Muell. ex Benth. to *Atylosia* (see Reynolds & Pedley 1981) and *R. rhomboidea* F. Muell. ex Benth. to *Nomismia*.

Nomismia rhomboidea (F. Muell. ex Benth.) Pedley, comb. nov. Based on *Rhynchosia rhomboidea* F. Muell. ex Benth., Fl. Aust. 2:265 (1864). **Type:** Victoria River, Oct 1855, Mueller (K, holo).

Western Australia. 22 miles [35 km] N of "Nicholson" Stn, Jul 1949, Perry 2380 (K); Ord River Dam, 16°07'S. 128°44'E, Jun 1974, Latz 5443. **Northern Territory.** 16 miles [26 km] WSW of "Victoria River Downs" Stn, Jun 1949, Perry 2103 (BRI, K).

Rhynchosia rostrata Benth. has the aspect of *Atylosia cinerea* but I have seen only the type (K) which lacks pods. Its position is therefore doubtful.

The solution to the problem of generic limits presented here is acceptable when Australian species are considered by may not be applicable throughout the ranges of *Atylosia*, *Rhynchosia* and *Nomismia*. *Atylosia*, *Cajanus*, *Dunbaria* and *Rhynchosia* are closely interrelated and further studies in the tribe are called for. For this reason I have not made any formal transfers of non-Australian taxa.

MIRBELIA SMITH

Mirbelia viminalis (Cunn. ex Benth.) C.A. Gardner, Enum. Plant. Aust. Occident. 57 (1930). Based on *Jacksonia viminalis* Cunn. ex Benth., Ann. Wien. Mus. 2:75 (1839).

Oxycladium semiseptatum F. Muell., J. Bot. & Kew Gard. Miscell. 9:20 (1857).

Mirbelia oxycladum F. Muell., Fragm. Phytog. Aust. 4:12 (1863); Benth., Fl. Aust. 2:38 (1864); F.M. Bailey, Qd Flora 2:340 (1900) nom. illeg. Based on *Oxycladium semiseptatum*.

BURKE DISTRICT: "Barkly Downs", May 1975, *Glasgow* (JCT). MITCHELL DISTRICT: Burra Range, between Pentland and Torrens Creek, Jun 1971, *Birch* (JCT). SOUTH KENNEDY DISTRICT: "Taemas" Stn, S. of Cape River, 21°14'S 146°24'E, Sep 1977, *Williams* 77202; "Mirtna" Stn, S. of Cape River Sep 1977, *Jacks* (JCT).

Bailey's inclusion of *Mirbelia viminalis* (as *M. oxyclada*) in "The Queensland Flora" was justified though it has only recently been collected in Queensland, a considerable distance from its nearest known collecting locality in the Northern Territory. It is easily distinguished from all other Queensland species of *Mirbelia* as it is the only leafless representative of the genus found in the state.

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NOTES ON QUEENSLAND ORCHIDACEAE, 2

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Summary

Two new species of *Orchidaceae* from Cape York Peninsula are described. These are *Cadetia collinsi* P. Lavarack sp. nov. and *Malaxis fimbriata* P. Lavarack sp. nov. *Peristylus banfieldii* (F.M. Bail.), P. Lavarack is a new combination based on *Habenaria banfieldii* F.M. Bail. *Habenaria anomala* Dockrill is a synonym of *H. xanthantha* F. Muell. and *H. ovoidea* R.S. Rogers & C.T. White is a synonym of *Peristylus candidus* J.J. Smith.

In the following, the type specimen has been cited only where it has been by the author.

Peristylus banfieldii (F.M. Bail.) P. Lavarack, comb. nov.

Habenaria banfieldii F.M. Bail., Qd Agric. J. 16:564 (1906); F.M. Bail., Comp. Cat. Qld. Plants:539, fig. 528. **Type:** North Kennedy District: Dunk Island, BRI 008612.

Until recently this species which was known only from the 'type' collection was placed in the genus *Habenaria*. Recent published work as exemplified by that of Seidenfaden (1977) has tended to confirm the existence of *Peristylus* as a separate generic entity. According to Seidenfaden the genus is characterized by 'an erect ovary rising close to the rachis, the caudicles of the pollinia very short without protruding protecting the cas of the anthers . . . spur is shorter than the ovary and most often reduced to a more or less globular sac shorter than the petals'.

Recently the author made a collection of this species near Mareeba (Cook District: Ckewko, about 10 km south west of Mareeba, 1st Aug. 1979, *Lavarack* 3001; BRI 080730). This species is closely related to *P. goodyeroides* (D. Don) Lindl., differing in the smaller flowers and in the absence of a clearly defined triangular nectary at the entrance to the spur.

It was possible to record some of the data missing from the type specimen: Flowering period (for the Mareeba population) January — March. Habitat: permanently wet soil beside a small creek, in full sun. The plants have an oblong tuber 3—4 x 2—3 cm.

Peristylus candidus J.J. Sm., Fl. Buïtenz. 6:36, Fig. 18 (1905); Seidenfaden, Orch. Genera in Thailand V: 60; Fig. 30 (1977).

Habenaria sumatrana (Schltr.) Schltr., Engl. Bot. Jahrb. 45, Beibl. 104:3 (1911); Holttum, Fl. Malaya 1:88, Fig 14a (1957); Dockrill, Aust. Indig. Orchids 1:50, 51 (1969).

Habenaria ovoidea R.S. Rogers & C.T. White, Proc. Roy. Soc. Qd 32:140-141 (1921); Dockrill, Aust. Indig. Orchis 1:32-33 (1969), *syn. nov.* **Type:** BRI 058344.

Careful comparison of the type of *H. ovoidea* with fresh material collected near Cardwell (*Lavarack* 3010; BRI 246783) and with the description and figures of *Peristylus candidus* by J.J. Smith and with the excellent figure quoted above by Seidenfaden have satisfied the present author that *H. ovoidea* is identical with *P. candidus*.

Habenaria xanthantha F. Muell., Fragm. Phyt. Aust. 7:16 (1869); Benth., Fl. Aust. 6:395 (1873); F.M. Bail., Qd. Flora 5:1591 (1902); Dockrill, Aust. Indig. Orchids 1:31-35 (1969); Rogers & White, Proc. Roy. Soc. Qd. 32:137-139 (1921). **Type:** MEL 89790-4.

Habenaria anomala Dockr., Orchadian 1:150-1 (1965); Aust. Indig. Orchids 1:30-31 (1969), *syn. nov.* **Type:** BRI 060247.

Dockrill (1969) made the comment in reference to *H. anomala* 'It is possible that it may prove to be merely a form of *H. xanthantha* F. Muell.' Some recent collections made near Cardwell in north Queensland have, in the opinion of the present author, confirmed this. A large population growing near Sunday Creek was examined and some plants fitting both the species in question were discovered. All the plants examined had very similar column structure but differences in the relative length of the stigmatophores were present. On careful examination of several inflorescences it was noted that these structures lengthen with age. Apart from this difference in the column, petals, sepals and vegetative parts of all plants collected were identical. The labellum varied with respect to the spur and the lateral lobes. All plants studied had a broad labellum of about constant length (3 x 7 mm). The spur ranged from totally absent to about 5 mm long with several specimens having a spur 0.5–1 mm in length. The length of the spur varied on individual flowers on a single plant, in one case 3 flowers had a small but definite spur while the other flower had no spur. The lateral lobes varied from long to short or absent with much variation evident among the flowers on each inflorescence.

Most of the flowers studied matched the description of *H. xanthantha* F. Muell. well except that in several cases the spur was 4 or 5 mm long instead of the stated 1–2 mm. One plant and one flower on another plant agreed well with the description of *H. anomala* Dockr. Some of the flowers seemed half-way between the descriptions of the two taxa as the spur was present, but only 0.5 mm long. (It is absent in *H. anomala*).

A careful comparison of the types of *H. anomala* and *H. xanthantha* indicated very little difference other than in the previously mentioned features of the labellum and spur. Both of these specimens would fit within the range of variation noted in the Cardwell specimens.

The presence of intermediate plants and flowers and the overall similarity of all plants studied (including the types) have lead to the conclusion that all the specimens observed represent one species, variable only in the labellum. This being the case, *H. anomala* Dockr. becomes a synonym of *H. xanthantha* F. Muell.

***Cadetia collinsii* P. Lavarack, species nova.**

Planta epiphytica; caules 6–18 x 1.5–2.5 mm; folia ovata usque lanceolata 11–22 x 5–10 mm emarginata; bractea floralis 2 mm longa. Pedicellus circa 3 mm longus; ovarium 1.5 mm longum pilis confertis carnosus circa 0.5 mm longis obiectum. Sepala ovata alba 3 x 2.5 mm; petala linearia alba; labellum saccatum oblongum album 3–4 x 1.5–2 mm indistincte 3-lobatum calcar circa 1 mm longo; columna erecta 1.5–2 x 1–1.5 mm dentibus duobus prominentibus integris apiculibus pilis longis confertis carnosus. **Typus:** COOK DISTRICT: Rocky River, Cape York Peninsula, 13°47'S 143°21'E, Sep 1975, Lavarack 1742 (BRI 244120, holotype).

Plant epiphytic forming small dense clumps. Stems 6–18 x 1.5–2.5 mm, consisting largely of a single internode, often enclosed for about half the length by the remains of a sheathing bract. Leaves 11–22 x 5–10 mm, ovate to lanceolate, emarginate, narrowing at the base to form a short petiole about 2 mm long. Flowers borne singly at the apex of the stem, floral bract about 2 mm long. Pedicel 3 mm long, ovary about 1.5 mm long covered with dense fleshy hairs about 0.5 mm long. Sepals ovate, white, 3 x 2.5 mm; petals linear, white 3 x 0.5 mm. Labellum oblong, 3–4 x 1.5–2 mm with a spur about 1.5 mm long, white, lateral lobes very small, disc sparsely and minutely pubescent. Column erect 1.5–2 x 1–1.5 mm with 2 prominent purple apical teeth extending above the anther, sparsely and minutely pubescent below the stigma. Stigma approximately square, about 0.8 mm across. Anther white with a short, broad rostrum, lower part of pollinia projecting over the upper part of the stigmatic surface. Capsule globose, 2–3 mm in diameter covered with long fleshy green hairs.

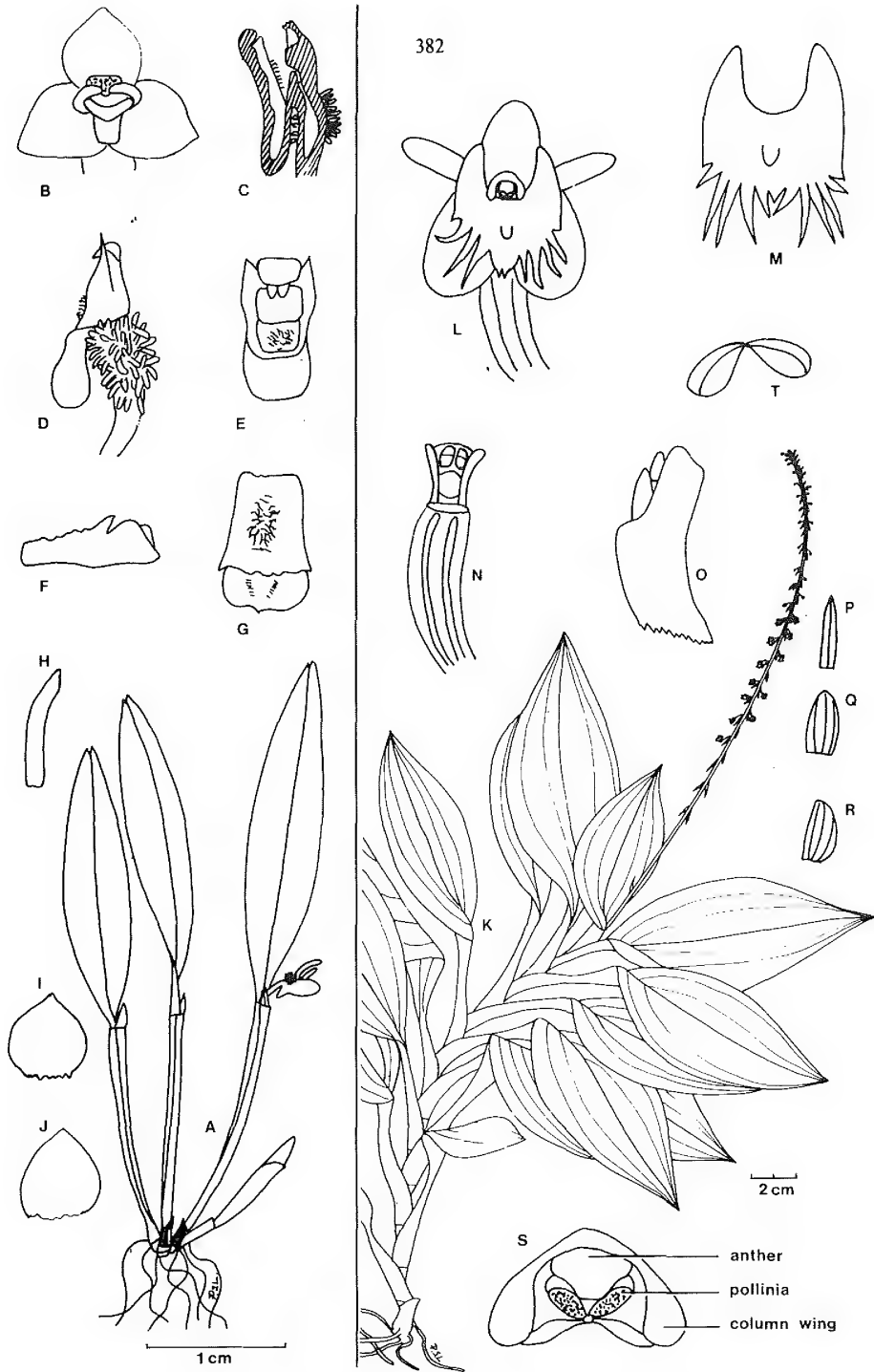


Figure 23. (a) *Cadetia collinsii* P. Lavarack sp. nov. A. Plant. B. Flower C. Section through flower. D. Flower from side, petals, sepals, and part of labellum removed. E. Column from front. F. Labellum from side. G. Labellum flattened out. H. Petal. I. Dorsal Sepal. J. Lateral sepal (A to indicated scale, B-J to various scales)

Figure 23 (b) *Malaxis fimbriata* P. Lavarack sp. nov. K. Plant. L. Flower from front. M. Labellum. N. Column and ovary O. Column from side. P. Petal. Q. Dorsal Sepal. R. Lateral sepal. S. Column from above. (K to indicated scale, L-S to various scales).

On examination of some unopened buds it was found that the pollinia were fused to the stigmatic surface. This, allied to the high incidence of fertilisation suggests that most, if not all, flowers are autogamous. *Cadetia collinsii* resembles *C. maideniana* (Schltr.). Schltr. but is smaller in all its parts and differs in the following features:

The labellum in *C. maideniana* has a thick fleshy midlobe, the apex being concave; while in *C. collinsii* the midlobe is only slightly fleshy and the apex is rounded with a small blunt point. The lateral lobes of the labellum are more pronounced in *C. maideniana* than in *C. collinsii*. The apical teeth on the column in the former is more slender than that of the latter. There are also differences in the shape of the sepals, all three being nearly equal in *C. collinsii*, giving the flower an almost regular appearance, while the lateral sepals differ from the dorsal in *C. maideniana* giving the flower a strongly zygomorphic appearance.

C. collinsii has been observed in the gorges of the Rocky River, Chester River and Leo Creek and in a gorge on the Janet Range about 100 km to the north. It is a plant of lowland creek gorges usually growing low down on trees in at least partial shade. The flowering period is spasmodic, but largely in December to April.

C. collinsii is named in honour of Rev. R. Collins of Atherton, who encouraged the author in his early studies of Australian orchids, and more recently, assisted on field trips to Cape York Peninsula, actually being present when this orchid was first officially collected.

Malaxis fimbriata P. Lavarack, species nova.

Planta terrestris, caules decumbentes teretes 20 x 1 cm; folia 4–15; petiolus canaliculatus vaginans 2.5–5 cm longus; lamina elliptica acuminata 7–12 x 3–5 cm. Inflorescentia 10–25 cm longa purpurea e floribus numerosis constans; pedicellus 7–10 mm longus ovario inclusus reflexus. Sepalum dorsalis 2.5–3 x 1–1.5 mm ovatum; sepala lateralalia 2–2.5 x 1.5 mm oblonga obtusa; petala 2.5–3 x 0.5 mm linearia; labellum 2.5–3 x 3.5–4 mm hippocrepiforme 8–12 dentibus prominentibus, pari medio brevi latoque 0.2–0.5 mm longo vel prominentiis brevis redacto et utrinque dentibus aliis angustis acutis 0.4–1.2 mm longis ultra labelli apicem extensis praeditum. Columna 1 x 0.8 mm alis latis obtusis ultra anther. **Typus:** COOK DISTRICT: Leo Creek, Cape York Peninsula, 13°33'S 143°28'E, Feb 1977, Lavarack 1768 (BRI 244121, holotypus). Collected Sep 1975, flowered in cultivation, Feb 1977.

Stems decumbent with the new shoots arising from the apical half of the previous stem, up to 20 cm long and 1 cm in diameter, terete, partly covered with scarious bracts and the remains of the old leaves. Leaves 4–15 on each stem, petiolate; petioles channelled, sheathing at the base 2.5–5 cm long; lamina 7–12 x 3–5 cm elliptical, broadest at the middle, acuminate, with 5 prominent veins. Inflorescence terminal, 10–25 cm long, rachis about twice the length of the peduncle; rachis and peduncle purple, 1.5–3 mm diameter, fluted; bracts on the peduncle about 5–7, reflexed, 5 x 1 mm; floral bracts similar; rachis with numerous densely packed flowers; pedicels 7–10 mm including ovary, reflexed. Flowers about 4 mm diameter, purple in all parts. Dorsal sepal 2.5–3 x 1.5 mm ovate obtuse; lateral sepals 2–2.5 x 1.5 mm, oblong, obtuse; petals 2.5–3 x 0.5 mm linear, at first spreading, later reflexing as the flower ages. Labellum 3 x 4 mm, horseshoe shaped, the apical and near apical margins with 8–12 prominent teeth, the central pair of teeth short and broad 0.2–0.5 mm long or reduced to a pair of small points on either side of a V-shaped notch; lateral teeth occupying about $\frac{1}{3}$ of the lateral margin, 3–5 on each side, narrow, acute, 0.8–1.2 mm long; the pair of teeth furthest from the apex much shorter, the longest of the lateral teeth extending beyond the apex of the labellum; auricles triangular, obtuse, 1.5 x 1 mm. Surface of mid part of labellum slightly concave. Column short and broad, about 1 x 0.8 mm, with 2 broad and blunt wings extending above the anther. Stigma approximately square. Anther small, 0.5 x 0.5 mm, broadly triangular. Capsule 5–8 mm long.

This species appears to be related to *M. decumbens* (Schltr.) P.F. Hunt from New Guinea, but differs in having much larger leaves and a relatively larger labellum with

teeth exceeding the apex of the labellum. The differences between several species, mostly described by J.J. Smith and by R. Schlechter from the Indonesian Islands and the island of New Guinea, appear to be quite slight and it is obvious that this genus is in need of revision. Taking this into account, *M. fimbriata* appears at least as discrete an entity as many of the species previously described, differing in a combination of features involving the plant habit, length of pedicel and shape and ornamentation of labellum. According to Schlechter (1911-1914) it would fit in the section *Comelinodes*.

M. fimbriata may be distinguished from other members of the genus within Australia by the decumbent habit, evergreen leaves and purple flowers.

This plant has been observed in a small area on the catchments of Leo Creek, Pandanus Creek and the Peach River above 500 m altitude. It grows in leaf litter on hillsides or on large rocks in dense shade on the rainforest floor forming large clumps. Flowering time is January to March.

Acknowledgments

The author is indebted to Mr. L. Pedley of the Queensland Herbarium who prepared the Latin diagnoses for *Cadetia collinsii* and *Malaxis fimbriata*. I also wish to express appreciation to Rev. R. Collins and Mr. B. Gray, both of Atherton, who provided very able assistance in the field and to Dr. G. Seidenfaden of Copenhagen who compared specimens of *Peristylus banfieldii* with *P. goodyeroides* on behalf of the author.

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ADDITION TO COMBRETACEAE (LAGUNCLURIEAE) FROM AUSTRALIA

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Summary

A new genus *Dansiea* (Combretaceae) and a new species *D. elliptica* from North Queensland, Australia are described.

***Dansiea* N. Byrnes gen. nov.** Lagunculariaceae generi *Macropteranthes* affinis sed habitu arboris, disco bilobo, ovario ad calycem adnato dorsaliter, ovulis pluris. Unica cognita species *D. elliptica* N. Byrnes Australiae tropicae incola.

***Dansiea elliptica* N. Byrnes sp. nov.**

Cook District: State Forest Reserve 310, Goldsborough L.A., 17°15'S 145°45'E, 18 Jan 1978, *B. Hyland* 3657RFK (holotypus BRI 241211; isotypi CANB, K).

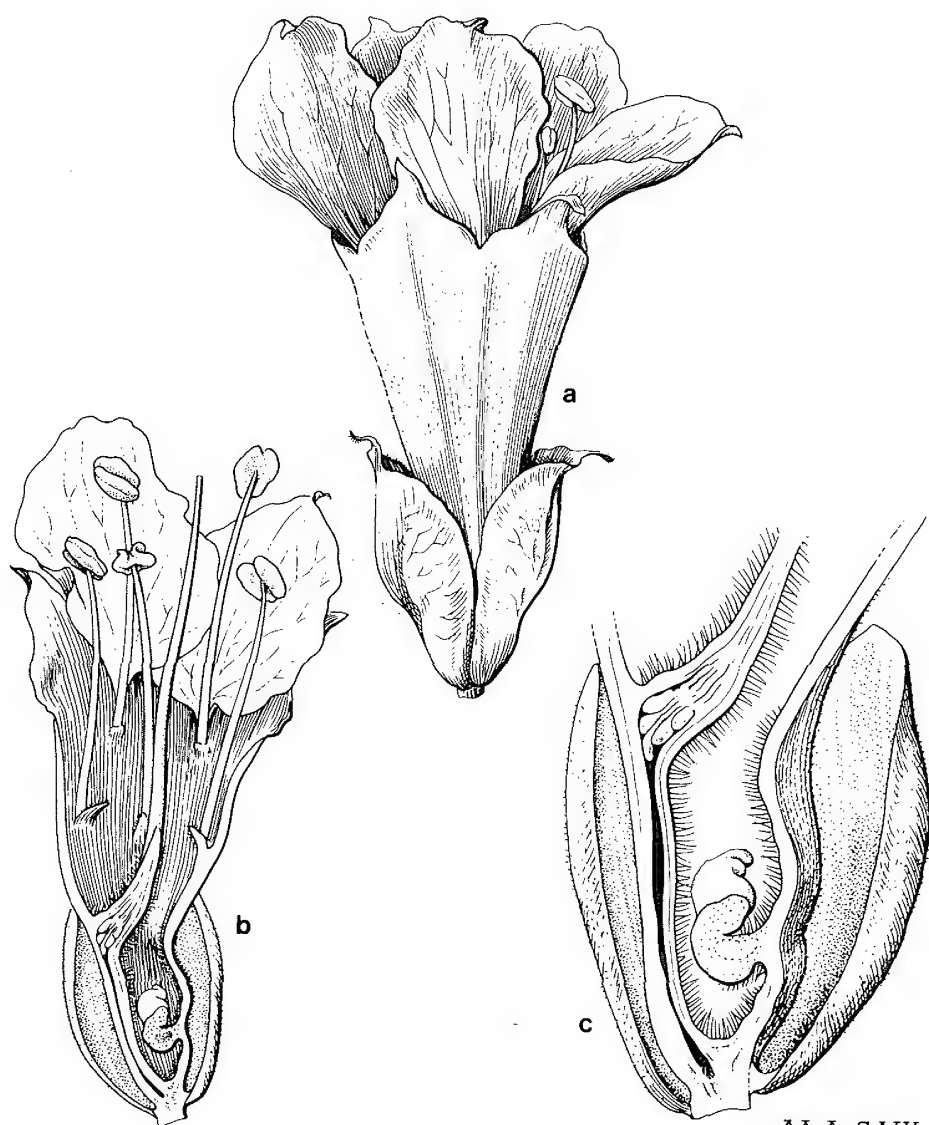
Arbor ad 35 m alta. Truncus cortice lamelloso. Folia spiralter disposita vel subopposita elliptica apice apiculata et basi breve attenuata 3–8.5 cm longa 1–3.5 cm lata margine integra glandulosa prope basi primo pubescentia dense appresse glabrescentia; petiolus 0.5–1 cm longus appresse pubescens. Flores axillares ca 2 cm longi; pedunculi ca 1 cm longi. Receptaculum tubularis non distinctum a calyce puberulum bracteolis adnatis persistibus accrescentibus in 5 lobis calyces terminans. Discus bilobus glandi similis. Petala 5 late elliptica apiculata 0.8–1 cm longa pubescentia decidua. Stamina 10, ca 1 cm longa tubi inserta duobus ordinibus filaments interioribus appendiculatis ad basim; antherae sagittatae versatiles. Ovarium pubescens uniloculare ad tubum adnatum dorsaliter; Stylus 8–10 mm longus; Stigma parvum; Ovula 14–20 pendula. Fructus ignoti.

Tree to 35 m tall. Trunk with flaky bark. Leaves spirally arranged or subopposite, elliptical, apiculate at apex, shortly attenuate at the base, 3–8.5 cm long, 1–3.5 cm wide, margins entire with glands near the base, at first densely appressed pubescent, glabrescent. Petioles 0.5–1 cm long, appressed pubescent. Flowers ca 2 cm long borne in the axils on peduncles ca 1 cm long. Receptacle tubular continuous and not distinct from calyx tube, terminating in the 5 calyx lobes, minutely pubescent with two enlarged persistent bracteoles adnate to the lower tube. Disc bilobed and gland-like. Petals 5, broadly elliptical 0.8–1 cm long, deciduous, pubescent. Stamens 10, ca 1 cm long inserted in the tube in two series with small appendages at the base of the filaments of the inner whorl. Anthers sagittate and versatile. Ovary pubescent, unilocular adnate dorsally to the floral tube. Style 8–10 mm long. Stigma small. Ovules 14–20, pendulous. Fruit unknown.

Queensland. COOK DISTRICT: State Forest Reserve 310, Goldsborough L.A., Jan 1979, *Hyland* 3653RFK, 3654RFK, 3655RFK, Dec 1977, *Gray* 815 & Jul 1979, *Hyland* 9956; Goldsborough Rd, Oct 1977, *Dansie* 20135; State Forest Reserve 756, Nov 1963, *Hyland* 556RFK.

Dansiea is a large rainforest tree to 35 m tall and 90 cm diam at breast height. The leaves bear two or more marginal glands and the lateral venation is visible on both surfaces. The glands are open, apparently non-secreting but have numerous cells containing crystals embedded in the tissue. The leaf indumentum consists of compartmented hairs typical of the family. Simple hairs and glandular trichomes are absent.

The flowers are superficially similar to *Macropteranthes* but are usually borne singly in the axils and the ovary is fused to the floral tube on one side only. A bilobed glandlike structure is present on the side of the floral tube opposite the ovary and represents the disc. This species has more ovules than any other member of the family. This new genus is related to the genus *Macropteranthes* which is represented



M.A. SAUL

Figure 24. *Dansiea elliptica*. Flower. a. External view. b. Longitudinal section. c. Section of base of floral tube.

by four species in Australia. These species are usually shrubs of the monsoonal areas with long dry winter periods. The flowers are borne in pairs on a common peduncle. The ovary is fused to the floral tube on all sides and the disc is cupular.

The indumentum on the young leaves of the *Dansiea* specimens collected in January is dense but mature leaves collected later in the year tend to be glabrous at least on the upper surface. The specimen (sterile) *Dansie* 20315 is almost completely glabrous retaining hairs on the veins and leaf margin. This reveals the pellucid punctate nature of the lamina that is obscured by the indumentum of the younger leaves. The absence of old and new leaves on the one specimen indicates the species may be deciduous if only for a short period just before the new growth and flowers appear.

This species is restricted in distribution to the rainforests near Mt. Bartle Frere. The species was first brought to attention by Mr S.J. Dansie, Forester and Collector but satisfactory flowering material was not available until collected by Mr. B. Hyland in January, 1978. Difficult weather conditions at the time of flowering contributed to the delay in obtaining adequate fertile material.

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NOTES ON SAPINDACEAE IN AUSTRALIA, I.

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Summary

Sapindaceae in Australia consists of 30 genera with over 180 species. Most of the species are found in Queensland, mainly in the rainforests of northern Queensland. *Castanospora*, *Diplopeltis*, *Distichostemon*, *Heterodendrum*, and *Sarcotoechia* are endemic. Detailed descriptions of, and keys to, all taxa are given. The genera *Diploglottis* (8 species), *Atalaya* (9 species), *Jagera* (3 species) and *Harpullia* (8 species) are treated in this first paper of a series.

Taxa described as new are: *Diploglottis harpullioides*, *D. pedleyi*, *D. smithii*, *D. macrantha*, *Atalaya sericopetala*, *A. angustifolia*, *A. calcicola*, *A. rigida*, *Jagera discolor*, and *J. pseudorhus* var. *integerrima*. *Diploglottis cunninghamii* (Hook.) Benth. & Hook. is the correct name for *D. australis* Radlk.

The family comprises about 150 genera and 2000 species, the majority of them being trees or shrubs; only a few (5 genera and 300 species) are climbers. They are mostly found in the tropics and subtropics and are most common in America and Asia.

The Sapindaceae in Australia are trees or shrubs, only one, *Cardiospermum*, which is introduced and now naturalised, is a vine. Most of the Australian species are found in Queensland, mainly in the rainforests of northern Queensland where they are usually important species in the rainforest communities, some are found in dry scrubs, others along creek and river banks and a few along the coast.

The family in Australia consists of 30 genera and over 180 species, of which 4 genera viz. *Cossignia*, *Dictyoneura*, *Lepidopetalum* and *Tristiropsis* are newly recorded, being the extension of their range mainly from New Guinea. About 25 species are either new records or new species. Some of the genera e.g. *Castanospora*, *Diplopeltis*, *Distichostemon*, *Heterodendrum*, *Sarcotoechia* are endemic to Australia.

Bentham in 1863 (Fl. Aust. 1:451-488) listed 16 genera and 82 species as occurring in Australia. Radlkofer in his treatment of the family from 1878-1932 split some genera and described some new genera and species and recorded 25 genera and about 135 species for Australia. Various authors viz. C.T. White, Domin, etc. from 1920 to 1936 described ten new species which were not included in Radlkofer's work. Since then only five new species have been described.

No major revisionary work have been done on the family in Australia except A.S. George's paper on *Diplopeltis* (1969) and a few short papers on *Dodonaea* since Radlkofer. The late L.S. Smith was very interested in the family and was an authority on the Australian species. He collected notes and specimens over the years and made annotations and some sorting of the Queensland material but was unable to publish any material on the family before his untimely death in 1970.

There has always been some confusion in the identity of the Queensland species especially the rainforest ones, mainly because of the incomplete nature of the specimens and because a lot of the genera had at least a few undescribed taxa amongst the species. In some cases there was no representative specimen of a particular species and Radlkofer's regional keys on some genera did not help. Because of the revisionary work of some of the Botanists at Leiden, chiefly Dr. P.W. Leenhouts on different groups of the family some with Australian representatives, a few of the genera occurring here have been straightened out. The need for the review of the family here became necessary when the family had to be written up for the Handbook to the Flora of South-eastern Queensland as a third of the species occur in the area. A lot of sorting and some collecting had to be done and some doubtful species checked against their types.

It was found that in some cases e.g. in *Arytera*, some of the confusion originated from the days of Mueller, Benthams and Radlkofer. In one case the type was a mixed collection and in the other the holotype held at Melbourne was different from the isotype distributed to Kew.

All the genera (except *Diplopeltis*) that occur here have been checked and studied and the review of all (except *Dodonaea* on which a separate revision is being carried out in Adelaide) will be published in parts. Although about 20 new species are to be described a lot more are still imperfectly known.

Many of the Sapindaceae are of economic value; several contain saponin in bark, twigs, leaves and pericarp; some yield valuable timber and others furnish edible fruits, the best known being *Dimocarpus longan* spp. *longan* "Longan", *Litchi chinensis* "Lychee" and *Nephelium lappaceum* "Rambutan", both "Lychee" and "Longan" are now cultivated in Australia.

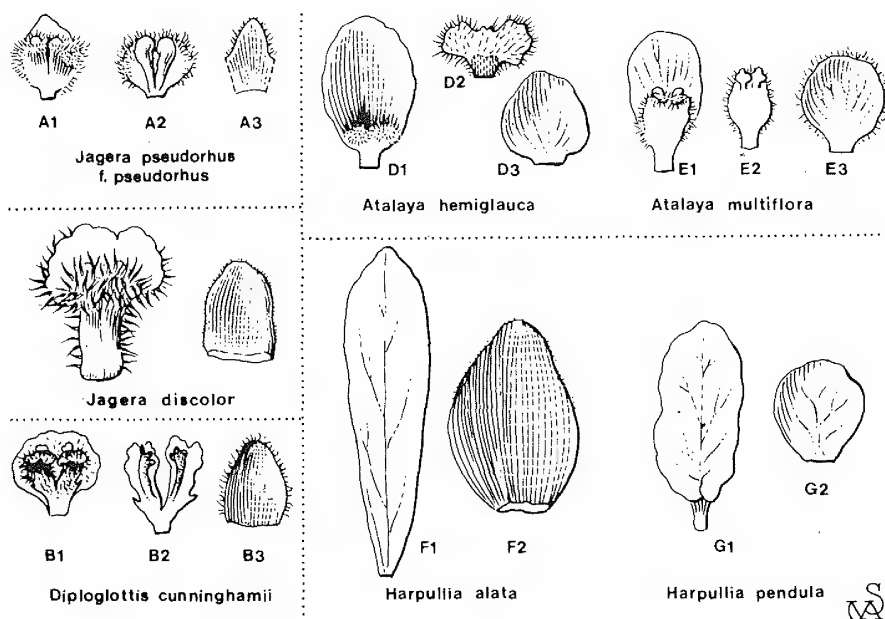


Figure 25. Flowers of some Sapindaceae. Petals, sepals and scales.

DIPLOGLOTTIS

Diploglottis Hook.f., Benth. & Hook.f., Gen. Pl. 1:395 (1862). **Type species:** *D. cunninghamii* (Hook.) Hook.f., based on *Cupania cunninghamii* Hook.

Trees usually monoecious, most species with large fluted rusty hairy branchlets and large leaves, rarely glabrous. Leaves paripinnate, often with large opposite to alternate entire leaflets. Inflorescences axillary, or pseudoterminal and forming large copiously flowered thyrsiform panicles; primary peduncles either stout ribbed and densely rusty hairy or pale hairy; cymules often sessile; bracteate. Flowers polygamous, regular or slightly irregular; pedicellate; calyces shortly cupular with 5 ovate lobes, or sepals free, broadly ovate, suborbicular or obovate and unequal, imbricate, often concave; petals 4 or 5, the fifth one often reduced, clawed, with bilobed hairy and usually crested scales, reduced petal often crestless; discs complete or incomplete, often oblique; stamens 6—9, filaments exerted, pilose in lower half; ovaries trigonous, usually hairy, style stout. Capsules usually large, transversely ellipsoid to irregularly globose, 2 or 3—sulcate with 2 or 3 globose lobes, or 1—lobed with aborted lobes usually small and reduced; usually completely 2 or 3—celled; 2 or 3—valved; valves thin or thick, usually hairy; seeds large, suborbicular slightly compressed, ascendent, nearly enclosed in thick, fleshy, acidic, usually bilobed, erose-margined aril.

Australia and probably also in New Guinea; eight species (four new) in eastern Australia.

1. Leaves with 1—3(—4) pairs of opposite or subopposite leaflets, usually glabrous; petioles and rachises glabrous or puberulent. Sepals obovate or suborbicular, unequal. Disc complete or incomplete with erect lateral lobe enclosing the stamens on one side 2
 Leaves with (2—)4—12 alternate or subopposite leaflets on each side of rachis, usually hairy especially on nerves on lower surfaces; petioles and rachises densely hairy to puberulent. Sepals usually ovate, rarely orbicular, equal or unequal. Disc complete or incomplete (then discs often crescent shaped and not enclosing the stamens) 3
2. Panicles 12—16 cm long and as wide. Capsules subglobose 3.5—7 cm long and in diam., rarely smaller, 2 or 3—valved with thin valves. Leaves with petiole (15—)24—33 cm long, glabrous or subglabrous; petiolules 2—5 mm long. Disc incomplete with erect lateral lobe enclosing the stamens on one side. 1. *D. campbellii*
 Panicles small and few flowered, 1—2.5 cm long and as wide. Capsules transversely ellipsoid mostly 2-lobed with subglobose unequal lobes, 3—4 x 3—6.2 cm, 2—valved with thick valves. Leaves with petiole 22—58 cm long, glabrous; petiolules 1—3.5 cm long. Disc usually complete, oblique 2. *D. harpullioides*
3. Younger parts especially young leaves, petioles, rachises, petiolules and nerves densely rubiginose or dark reddish brown hairy with villous hairs. Capsules with glabrous valves usually 1(or 2)—lobed with reduced aborted lobes at its base, subglobose or ellipsoid, oblique, 1-celled, 2-valved. Sepals orbicular; petals usually with thin crests. Pinnæ 11—19(—23) in number 3. *D. pedleyi*
 Younger parts, young leaves, petioles, rachises, petiolules and nerves not dark reddish brown hairy as above, hairs either ferruginous or very pale. Capsules with valves hairy at least inside, irregularly globose to transversely ellipsoid; 3-celled with 3 thick valves, or (1—)2 or 3—sulcate or —lobed, lobes subglobose, 1—celled, 2—valved with thin valves. Sepals ovate; petals crested except some reduced ones. Pinnæ 6—10(—18) in number 4
4. Panicles conspicuously bracteate with sessile or subsessile cymules in axil of bracts, usually scurfy and pale hairy. Bracts 4—35 x 3—6 mm, pale hairy. Branchlets, petioles, rachises and peduncles usually pubescent or puberulent with pale short appressed hairs often intermingled with long rusty hairs. Leaflets 8—14 in number. Branchlets slender 5
 Panicles not as above, usually rusty hairy; bracts to 7 x 3 mm, rusty brown hairy outside. Branchlets, petioles, rachises and peduncles usually densely rusty villous hairy. Leaflets 4—10(—18), usually large. Branchlets mostly stout and fluted 6
5. Pinnæ with numerous lateral nerves, 24—34 pairs, 3—7 mm apart, often with secondary nerves between them, usually depressed above, bullate. Peduncles densely hairy with somewhat crispate hairs intermingled with long rusty hairs; bracts to 8 x 3 mm, ovate acuminate. Capsules 1.4—1.8 x 2—3.5 cm, transversely ellipsoid or subglobose 1—3 celled; valves 2 or 3, thin 4. *D. smithii*
 Pinnæ with 11—23 pairs of lateral nerves, 6—15 mm apart, not bullate. Peduncles globose at base, pubescent with short pale appressed hairs; bracts to 35 x 6 mm, oblong ovate, acuminate,

- grooved in the middle. Capsules 2.8—3.6 x 2.8—4.5 cm, subglobose 3-celled; valves 3, thick, rindlike, drying sub-woody 5. *D. bracteata*
6. Petioles 0.7—3.5 cm long. Panicles slender, not divaricately branched, 6.5—13 cm long and to 3 cm wide. Flowers 7—8 mm diam. Leaflets 6—10, mostly ovate-oblong or oblong, acuminate-apiculate at tips. Shrubs or small slender, unbranched trees 2—4 m. 6. *D. macrantha*
- Petioles 0.2—1.5 cm long. Panicles divaricately branched, 12—50 cm long and nearly as wide; primary peduncles usually stout and fluted. Flowers 4—6 mm diam. Leaflets 4—18, usually oblong or elliptic-oblong, often wider above the middle, tips broad, rounded or abruptly and shortly acuminate. Trees (6—)10—30 m tall, branching at the top 7
7. Leaflets usually oblong with broad, truncate or obtuse bases, unequal and cut to about second last pair of lateral nerves, and broad, rounded apices, 9—51 x 5—18 cm; petiolules 2—15 mm long. (Leaf with petiole (28—) 45.5—130 cm long with 3—5(—8) leaflets each side of rachis. Branchlets and primary peduncles stout and fluted) 7. *D. cunninghamii*
- Leaflets usually elliptic-oblong or subobovate-elliptic, often broader above the middle, acute, obtuse and oblique at base and rounded or abruptly and shortly acuminate at apices, 4.5—23 x 2—9.5 cm; petiolules 2—6 mm long. (Leaf with petiole (14—)38—70 cm long with (2—) 3—9 leaflets each side of rachis. Branchlets and primary peduncles usually slender) 8. *D. diphylostegia*

1. *Diploglottis campbellii* Cheel, Proc. Linn. Soc. N.S.W. 48: 685 (1923); Francis, Aust. Rain-For. Trees, ed 3:256 (1970). **Syntypes:** Tintenbar, Feb 1892, *M. Bauerlen* (not seen); Tweed River, *R.A. Campbell* (not seen).

Trees 8–20 m, young parts sericeous hairy; branchlets, petioles and rachises puberulent with pale short usually antrorse hairs intermingled with long hairs, lenticels small, broadly elliptic. Leaves with petiole (15—)24—33 cm long with (1—)2—4 pairs of leaflets; petioles semiterete, 3.5—7 cm, pulvinate; rachises adaxially ridged, 2—10 cm; pinnae usually opposite and decreasing in size from apex to base, elliptic-oblong or —subobovate or —ovate, acute or abruptly and shortly acuminate at apices, subacute or obtuse, oblique or unequal at base with one side decurrent into petiolules, 7—19 x 2.5—7 cm, glabrous or lower surfaces subglabrous, puberulent on midribs, semicoriaceous, lateral nerves 10—14 pairs, subpatent; petiolules semiterete, 2—5 mm, pulvinate. Thyrsiform panicles axillary or supra-axillary, laxly branched and flowered, 12—16 cm long and as wide, peduncles tomentose or pubescent. Flowers to 5 mm diam.; pedicels to 3 mm, pubescent; calyces 5—partite, lobes imbricate, obovate or suborbicular, concave, 2.5—4 x 2—3 mm, pubescent; petals 4 or 5, subspathulate, rounded at apex, long clawed with tubular claw, 2—2.5 x 2 mm, scales bilobed longer than lamina, villous, crests yellowish; disc incomplete with oblong erect lateral lobe enclosing the stamens on one side; stamens 8 or 9, curved and inflexed towards the erect lobe of disc, filaments 3—4 mm, glabrous, ovaries 3-celled, pubescent. Capsules subglobose or depressed ovoid, obscurely 3-sulcate, 3.5—7 x 3.5—7 cm, rarely small and globose to 2 x 2 cm, brownish and thinly hairy; seeds subglobose often enclosed in fleshy, acidic, bilobed red aril.

Restricted to southern Queensland and northern New South Wales from Tintenbar, Richmond River to Tallebudgera Creek area, not common.

Queensland. MORETON DISTRICT: Tallebudgera Creek, Dec 1917, *White & Young* s.n. **New South Wales.** Byron Bay, Feb 1975, *Willows* s.n.; Road up to Mt Warning approx. 1 km past the creek crossing, Apr 1979, *Jessup* 196.

2. *Diploglottis harpullioides* S.T. Reynolds species nova; a speciebus ceteris Australianis foliis glabris et perbrevisibus inflorescentibus differt. **Typus:** Cook District: Harvey Creek, 12 October 1973, *L.J. Webb & J.G. Tracey* s.n. (BRI, holotypus).

Small trees 3—5 m, branchlets puberulent or glabrescent with minute, appressed pale hairs, lenticellate, striated. Leaves with petiole 22—58 cm long, with (1—)2—4 pairs of leaflets, (leaves decreasing in size from apex to base); petioles 5.5—14 cm, subterete, shortly pulvinate and globose at base, glabrous; rachises 3.5—27 cm, subterete, glabrous; pinnae opposite, elliptic-oblong or subovate-elliptic-oblong or subobovate-elliptic, abruptly acuminate at apices, acute and very oblique at base, 8—23.5(—31.5) x 3.5—8(—10.5) cm, glabrous, coriaceous, lateral nerves 9—14 pairs,

subpatent, arched and ascending and anastomosing near margins, prominent, midribs raised, reticulations lax; petiolules 1—3.5 cm, slender, subterete, slightly channelled above pulvinate base, puberulent. Panicles small, axillary, usually on short lateral branchlets in axil of fallen leaves, 1—2.5 cm long and nearly as wide, usually branching from the base, cymules 2 or 3-flowered; peduncles pubescent; bracts minute. Buds globose; flowers to 5 mm diam.; pedicels 5—7 mm, articulate towards base, densely appressed hairy; sepals imbricate, broadly ovate or orbicular, concave, 4 x 3.5—5 mm, unequal, outer pair smaller, ciliolate, appressed pubescent outside, glabrous inside; petals 5, broadly ovate-orbicular, shortly clawed, membranous, delicately veined, 2—5.5 x 2.5—5.5 mm, glabrous outside, puberulent inside towards the claw and scales, scales bilobed with thin crests; disc glabrous, repand and often fleshy and suboblique; filaments 2—4 mm long, pilose; ovaries 3-celled, villous, style short. Capsules transversely ellipsoid usually 2-lobed with \pm orbicular lobes, or 1-lobed and subglobose, with aborted lobes towards base 3—4 x 3.5—6.2 cm, 2-valved, valves thick (to 4 mm thick) appressed pubescent inside; seeds orbicular, slightly compressed, enclosed in fleshy bilobed red aril.

Northern Queensland, from Cedar Bay, near Bloomfield River to around Babinda, in rainforests.

COOK DISTRICT: Cedar Bay, near Bloomfield R, Feb 1973, *Dick* s.n.; Weinert's Ck, Babinda (17°20'S, 145°55'E), Nov 1977, *Jago* 272 (QRS).

This species differs from the rest of Australian species in the glabrous leaves and very short inflorescences.

3. ***Diploglottis pedleyi*** S.T. Reynolds species nova; a speciebus ceteris Australianis ramulis petiolalis rhachidibus et pedunculis omnibus dense atrorufescenter villosis et foliolis pluribus, 5—12—jugis differt. **Typus:** Cook District: The Boulders, Babinda Creek, ca 6 km W of Babinda, 31 Aug 1954, *L.S. Smith* 5336 (BRI, holotypus).

Small trees, 7—9 m, often multistemmed, young parts especially young leaves densely red-rusty villous hairy and furry; branchlets ribbed, stout, villous hairy. Leaves with petioles 56—64.5 (—82) cm long, with 5—10 (—12) leaflets each side of rachis; petioles 10.5—19 (—24.5) cm, semiterete, flattened above at broad pulvinate base; rachises 16.5—36.3 (—59.5) cm, terete, bi- or trisulcate; pinnae opposite or subopposite, narrowly elliptic-oblong, tips abruptly and shortly acuminate, bases obtuse, truncate, oblique, 10—28 (—33.5) x 3.4—5.7 (—6.5) cm, glabrous or the midribs puberulent, semicoriaceous, lateral nerves 18—25 pairs, arcuate, raised below and often impressed above; petiolules 0.8—2 cm, slender, pulvinate. Panicles axillary, usually clustered at tips of branchlets, 6—10 x 1.5—11 cm, laxly branched with spiciform branches bearing clusters of usually 3-flowered sessile cymules; bracts 3 x 1.5 mm, ovate, concave, rusty hairy outside, glabrous inside. Buds globose; flowers (hermaphrodites) to 11 mm diam., cream; sessile; sepals imbricate, outer pair smaller, 3.5—4 x 4 mm, orbicular, concave, glabrous or rarely puberulent outside, ciliolate on pale margins, glandular dotted; petals 5, none reduced, broadly ovate, clawed, 3—4 x 2.5 mm, glabrous except claw, scales bilobed with crest-like appendages or crests thin, scales hairy on margins; disc 5-lobed or crenate, fleshy, glabrous; filaments to 1.5 mm long, pilose, anthers oblong-ovoid to 2.5 mm, pilose at sutures; ovaries puberulent, 3-celled. Capsule subglobose or transversely ellipsoid, oblique, usually 1 (—2)-lobed with reduced aborted lobes often present near its base, sessile, 3.5—5.5 x 4.5—7.5 cm, glabrous; 2-valved, valves coriaceous, glabrous inside; seeds suborbicular, oblique, slightly compressed, 3—4 x 3.5—4 cm, nearly enveloped by fleshy (5—8 mm thick) bilobed red aril.

Northern Queensland, chiefly coastal in the Babinda-Innisfail area, in rainforests.

COOK DISTRICT: The Boulders, Babinda, 30 Aug 1949, *Krause* 3; S.F.R. 755, Barong L.A., (17°31'S, 146°30'E), 13 Sep 172, *Dansie* s.n. (QRS 22791-22796); 9 Sep 1976, *Fitzsimon* 56 (QRS); 28 Oct 1976, *Hyland* 9157; McNamee Ck near Palmerston National Park, 31 Oct 1968, *Webb & Tracey* 8322.

This species differs from the rest of Australian species in the dense deep rusty red villous hairy branchlets, petioles, rachises, petiolules and peduncles. The leaflets are also more numerous, being 5–12 paired, and the large fruit is glabrous.

It is named in honour of Mr. L. Pedley who is very interested in the genus and has helped sort out the many problems, especially the nomenclature, of the family in Australia.

- 4. *Diploglottis smithii*** S.T. Reynolds sp. nov. Species haec a ceteris differt nervis lateralibus numerosis (24–28–jugis) approximatis inter se 3–7 distantibus patentibus impressis supra. Inflorescentiae et bracteae *D. bracteatae* similes.
Typus: Cook District : Paronella Park, Muna Creek near Innisfail, Aug 1948, *L.S. Smith* s.n. (BRI, holotypus).

Trees 7–15 m tall and 22–60 cm girth, buttressed; young parts especially young leaves furry or densely rusty villous hairy; branchlets ribbed, lenticellate, densely appressed hairy with short pale appressed hairs intermingled with longer rusty hairs. Leaves with petiole 29–47 cm long, with 4–6 leaflets each side of rachis; petioles 6.5–12 cm, semiterete, slightly margined, pulvinate, often lenticellate, puberulent; rachises 10.5–28 cm, often bisulcate above, lenticellate, pubescent or puberulent; pinnae alternate or opposite, lowermost pair the smallest, elliptic or elliptic-oblong often abruptly narrowing at both ends, or obovate-elliptic, acute, obtuse or abruptly and shortly acuminate at apices with emarginate acumen, bases obtuse or acute and shortly decurrent, oblique and subequal, (6–)9–19.5(–26) x 2.5–7(–11.5) cm (juvenile leaves simple, to 38 x 11.5 cm), glabrous and shiny above, puberulent especially on nerves or glabrous below, minutely papillose on lower surfaces, semi-coriaceous, lateral nerves 24–34 pairs, close to each other, 3–7(–10) mm apart, often with secondary nerves between them, subpatent, arched and ascending at tips, nerves depressed above, bullate, reticulation dense; petiolules 0.5–1.4 cm, grooved above, pulvinate, puberulent. Thyrsiform panicles supra-axillary or pseudoterminal, laxly branched, 13–32 x 13–27 cm, peduncles densely minutely hairy with somewhat crispate tomentum intermingled with longer straight rusty hairs, ribbed, bearing sessile 4–7-flowered cymules in axil of bracts; bracts narrowly oblong-ovate, 5–8 x 2–3 mm, crispate tomentose outside, glabrous towards the base inside, deciduous. Flowers (females) about 5 mm diam.; pedicels to 3 mm long, articulate about middle, pubescent; calyces 5-lobed, lobes subequal, ovate, 2.5–3 x 2 mm, crispate tomentose outside, pubescent inside except glabrous base; petals 5, one usually reduced, broadly suborbicular, long-clawed, or spatulate, glabrous except crispate hairy scales, 3.5 x 2.5 mm, scales bilobed, crested; disc almost complete, rarely oblique, crenate, glabrous; filaments subulate 2 mm long, pilose towards base; ovaries subglobose, tomentose, style stout, 2–3 mm long, glabrous. Capsules transversely ellipsoid or subglobose, 1.4–1.8 x 2–3.5 cm, ± obscurely 2 or 3 sulcate, usually with pale or whitish bloom; valves thin, finely pale greyish or whitish pubescent outside, puberulent inside with appressed scattered hairs; seeds brown enclosed in red juicy acidulous aril.

Northern Queensland from Bloomfield River to Innisfail area where it is quite common in rainforests.

COOK DISTRICT: Gap Creek about 38 km S by E of Cooktown, Aug 1959, *Smith* 10739; Daintree, *Rosenstrom* s.n.; National Park Reserve 904 (17°35'S, 145°45'E), Oct 1968, *Hyland* 2025; The Boulders near Babinda in 1956, *Wilkie* s.n.

The species differs from the rest in having numerous lateral nerves (24–28 pairs), close to each other, 3–7 mm apart, patent, impressed above. Inflorescence and bracts similar to *D. bracteata*.

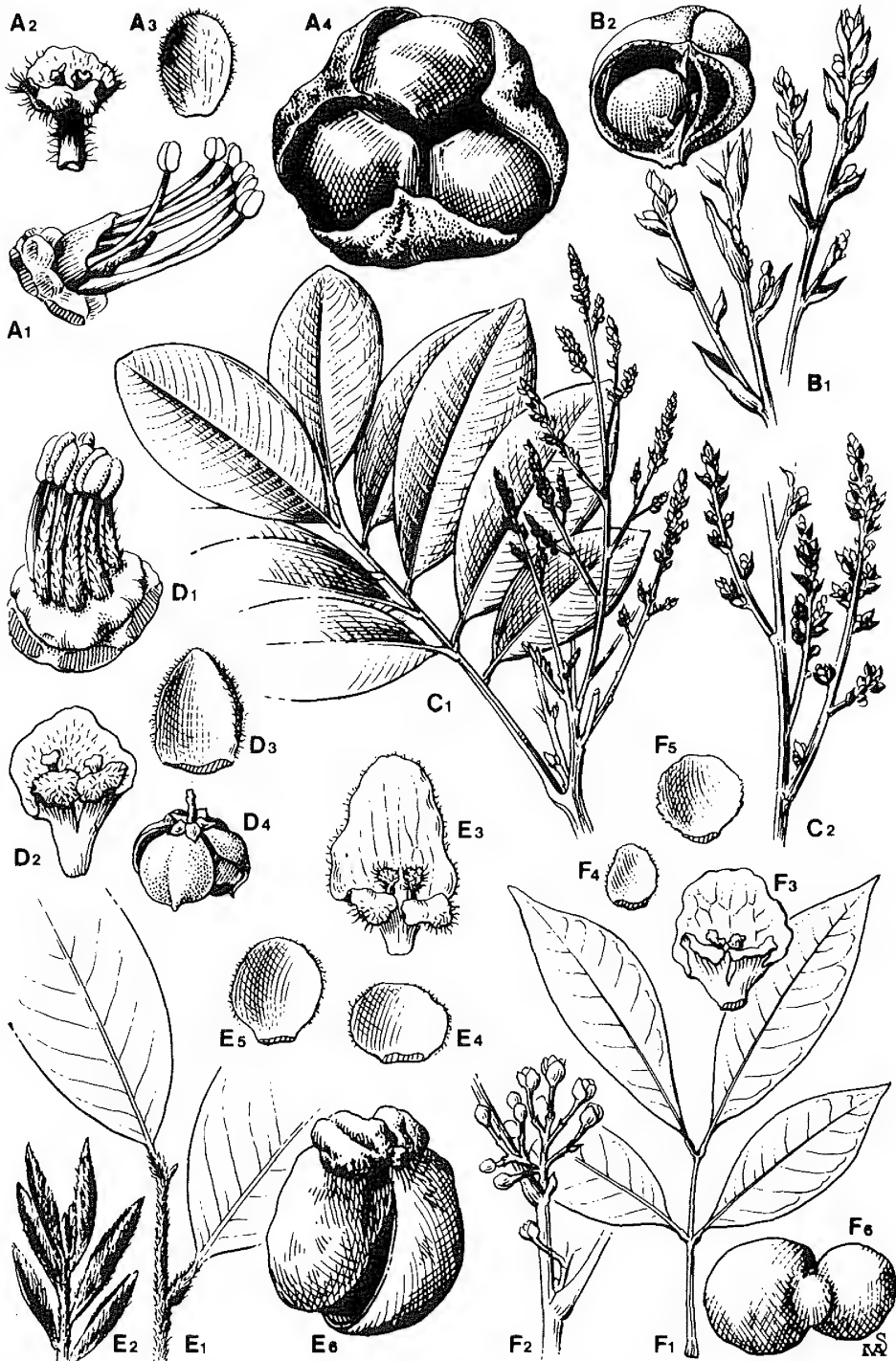


Figure 26. *Diploglottis*. A. *D. cambellii*. A1. Flowers, sepals and petals removed (x 8). A2. Petal (x 8). A3. Sepal (x 4). A4. Fruit (x 2/3). B. *D. bracteata*. B1. Portion of inflorescence (x 2/3). B2. Fruit (x 2/3). C. *D. smithii*. C1. Leaf. C2. Portion of inflorescence (x 2/3). D. *D. macrantha*. D1. Flower, sepals and petals removed (x 6). D2. Petal (x 6). D3. Sepal (x 6). D4. Fruit (x 2/3). E. *D. pedleyi*. E1. Portion of leaflet (x 1). E2. Young leaflets (x2/3). E3. Petal (x 6). E4 & 5. Outer and inner sepals (x 6). E6. Fruit (x 1/2). F. *D. harpullioides*. F1. Leaf. F2. Portion of inflorescence. F3. Petal (x 6). F4 & 5. Outer & inner sepals (x 6). F6. Fruit (x 1/2).

It is named after the late Mr. L.S. Smith who was an authority on Australian Sapindaceae.

5. *Diploglottis bracteata* Leenh., *Blumea* 24 (1) : 176 (1978). **Type:** Cook District: Gadgarra and Ghurka Pocket, *L.S. Smith* 1057. (BRI, iso).

Small trees to 10 m, and 25 cm girth, young parts, branchlets, petioles, rachises, petiolules and peduncles with appressed short pale pubescence; branches 5-ribbed, lenticellate. Leaves with petiole (19-) 30-57 cm long, with 4-7 leaflets each side of rachis; petioles 3.5-9 cm, semiterete, slightly margined, flat above at broad, pulvinate base; rachises 6-24 cm, flattened and slightly margined above; pinnae alternate or subopposite, elliptic oblong, tips obtuse or shortly abruptly acuminate with emarginate acumen, bases acute, attenuating and shortly decurrent into petiolules, 5.5-23 x 2-6.5 cm, glabrous above or midribs hairy, puberulent, often scurfy and papillose below, semicoriaceous, lateral nerves 11-23 pairs, subarcuate; petiolules 0.8-1.8 cm, grooved above. Thyrsiform panicles axillary or pseudoterminal, often divaricately branched, 15-31 x 13-26 cm; peduncles ribbed, globose at base; bracts mostly oblong ovate, 0.8-3.5 x 0.4-0.7 cm, hoary pubescent and scurfy outside, puberulent to glabrescent inside. Flowers in 3 or 4-flowered sessile cymules, 4.5-6 mm diam., males smaller; pedicels 4-11 mm, articulate below middle, tomentose; calyx lobes broadly ovate, imbricate, crispate hairy except glabrous base; petals 5, none reduced, broadly obovate, shortly clawed, 3-3.5 x 2-2.5 mm, glabrous or puberulent only towards base outside, scales bilobed, obovate, nearly as long as petals, crispate hairy, crests stipitate; disc annular, fleshy, glabrous; stamens 7-8, filaments subulate, 3-4 mm long, pilose from middle to base; ovaries subglobose, tomentose, style 3 mm long, pilose to subglabrous. Capsules subglobose 2.8-3.6 x 2.8-4.5 cm, \pm 3-gonous, 3-celled, valves coriaceous, thick (to 4 mm thick), rind-like, wrinkled, (somewhat woody when dry) finely and minutely tomentose outside, villous inside with appressed hairs; seeds globose embedded in bilobed aril.

Northern Queensland, around Atherton Tableland, in rainforest remnants usually at high altitudes.

COOK DISTRICT: Forest Reserve 310, Gadgarra, Aug 1964, *Volck* 3464; Butchers Creek Rd about 8 km E of Malanda, Nov 1969, *Volck* 4399; Portion 12, Parish of Malanda (17°18'S, 145°39'E), Sep 1977, *Gray* 677 (BRI, QRS).

6. *Diploglottis macrantha* L.S. Smith ex S.T. Reynolds sp. nov. Species nova *D. cunninghamii* proxima a qua imprimis floribus majoribus (circa 8 mm diametro) habitu (statura minore 2-4 m) foliis apicem acuminatis et longipetiululatis differt. **Typus:** Cook District: Iron Range, 27 Jul 1949, *H. Flecker* 13158 (BRI, holotypus).

Shrubs or small trees 2-4m, unbranched; young parts especially young leaves densely velutinous hairy with dark brown hairs; branchlets stout, fluted, densely ferruginous hairy, so also are petioles, rachises, petiolules and peduncles. Leaves large, with petiole 36-47(-86) cm long, with 3-5 large leaflets each side of rachis; petioles 15.5-17.5(-27) cm, terete trisulcate, broad at base; rachises terete ribbed, 21-34(-45.5) cm; pinnae subopposite or alternate, usually oblong ovate narrowing towards acuminate apex, or elliptic oblong, apices usually abruptly and shortly acuminate and apiculate, bases unequal, broadly obtuse or somewhat rounded or truncate, (8.5-)14-22(-27) x (4-)7-8.5(-13) cm, puberulent above, pubescent or puberulent below with the midribs and nerves densely rusty hairy, usually pellucid dotted below, upper surfaces drying paler and duller, semicoriaceous, lateral nerves 13-30 pairs, suboblique, arched and ascending at tips, slightly impressed above, bulate and often transversely corrugate between the nerves, reticulations lax; petiolules 0.7-3.5 cm with the basal leaflets on longer stalks, broad at base. Thyrsiform pani-

cles axillary, slender, 6.5–13 cm long and to 3 cm wide, with dense cluster of cymules, peduncles ribbed, lined by short decurrent flower-bearing branches; bracts ovate-oblong 4–6 x 2–3 mm, rusty velvety tomentose outside, subglabrous especially towards base inside. Flowers cream, 7–8 mm diam., males smaller; pedicels 6–8 mm, articulate about middle, tomentose; calyx lobes 5, ovate, 3–5 x 2.5–3.5 mm, often carinate towards apex, yellow-brown crispate tomentose; petals 5 (one often reduced and crestless), suborbicular and long clawed or spatulate, 4–5 x 2.5–3 mm, hoary towards base and claw outside, densely hairy on scales and claw inside, scales as long as petals, bilobed, crested; disc glabrous, complete or nearly so, suboblique, often crenate on one side; stamens 8–10, filaments subulate, 4–5 mm, pubescent from middle to base, anthers broadly ovate, to 1 x 1 mm; ovaries trigonous, globose, villous, style 5 mm long, pilose. Capsules very broadly obovoid or obcordate, apiculate, 1.5–2 x 2–4 cm, 3 or 2-sulcate, golden rusty velutinous tomentose outside, valves semicoriaceous, pilose pubescent inside with appressed hairs; seeds subellipsoid, brown, nearly covered by orange-red aril.

Northern Queensland, Cape York Peninsula (from Bamaga to Iron Range and along McIlwraith Range). Scattered in gallery rainforests or dry monsoon forests, usually on stony soil, on hills and beside creeks.

COOK DISTRICT: Bamaga Mission, Oct 1965, *Smith* 12411; Tozer Gap, Tozer Range, Jul 1910, *Brass* 19520; Mt. Tozer flank (12°45'S, 143°10'E), Jun 1972, *Irvine* 229; Kennedy Road, W. Claudie River (12°45'S, 143°15'E), Aug 1965, *Gittins* 1041; Leo Creek (13°40'S, 143°20'E), Sep 1972, *Hyland* 6386; T.R. 14 Rocky River, (13°50'S 143°25'E), Sep 1973, *Hyland* 6798.

The species is closest to *D. cunninghamii* but differs chiefly in large flowers (about 8 mm diameter), habit (smaller stature 2–4 m), leaflets with acuminate tips and long petiolulate.

7. **Diploglottis cunninghamii** (Hook.) Hook.f. in Benth. & Hook., Gen. Pl. 1:395 (1862); Benth., Fl. Aust. 1:454 (1863); F.M. Bailey, Qd Fl. 1:287 (1899); Domin, Biblioth. Bot. 89:905 (1927). Based on *Cupania cunninghamii* Hook., Curtis Bot. Mag. 75, t.4470 (1849). **Type:** Cultivated specimen at Kew (not seen).

Stadtmannia australis Cunn. mss., Curt. Bot. Mag. 75, t.4470 (1849), *pro syn.* *Diploglottis australis* Radlk., Sitzungsber. bayer. Akad. 9:486, 499, 531 (1879). Based on *Stadtmannia australis* Cunn. mss. non G. Don "Diploglottis australis (G. Don) Radlk."; R.H. Anders., Trees of N.S.W. ed. 3:254 (1957); Beadle, Evans and Carolin, Handb. Vasc. Plants Sydney Dist. ed. 1. 324 (1962); Francis, Aust. Rain-For. Trees ed. 3:252 (1970).

Misapplied name: *Stadtmannia australis* G. Don, Gen. Syst. 1:669 (1831).

Trees 6–35 m, branching at top; young parts especially young leaves rusty velutinous tomentose; branchlets stout, fluted, densely rusty villous hairy with spreading hairs; petioles, rachises, petiolules and peduncles also rusty tomentose. Leaves large, with petiole (28–) 45.5–130 cm long, with 3–5(–8) large leaflets each side of rachis; petioles 8–11(–17) cm, terete, trisulcate, broad at base; rachises 11–35(–71) cm, terete, trisulcate; pinnae subopposite or alternate, oblong or elliptic-oblong, rarely oblong-ovate or often basal pair obovate, tips broad, rounded, obtuse or rarely abruptly acuminate, margins repand, bases usually broad and truncate, oblique unequal and usually cut on one side to about second last pair of lateral nerves, rarely obtuse, 9–33(–51) x 5–12(–18) cm, (juvenile leaves often simple, obovate-oblong, to 29 x 12 cm), upper surfaces usually glabrous except rusty midribs, lower ones pubescent to puberulent often pellucid dotted, semicoriaceous, lateral nerves 19–28 pairs, suboblique, parallel, bullate between nerves and transversely corrugate; petiolules 0.2–1.5 cm, semiterete, broad at base. Panicles in upper axils often clustered below velutinous young leaves, usually large with stout peduncles and divaricate branches, 12–50 cm long and as wide, copiously flowered.

Flowers 4–6 mm diam.; pedicels to 6 mm, villous; calyces 4 mm long, lobes ovate, 2.5–3 x 2–2.5 mm, densely villous outside; petals 4, rarely with reduced fifth one, broadly obovate and shortly clawed, 2.5 x 2.5 mm, glabrous; scales 2, broad, as long as petals, crests fleshy, stipitate; disc incomplete, glabrous; stamens 8–10, filaments subulate, 3 mm long, pilose from middle to base; ovary subglobose, hairy, style simple. Capsules yellow-orange, subglobose and 1-celled or transversely ellipsoid, 3 or 2–sulcate or lobed, 1.3–1.8 x 2.5–3 cm, turgid, valves thin, veined, pale rusty velvety hairy on outside, pilose puberulent inside; seeds brown, orbicular, carinate on margins, nearly covered by 2–lobed orange-red acidic aril.

Southern Queensland as far west as Bunya Mountains and to Illawarra District in New South Wales, usually to altitudes around 1,000 m; in rainforests.

Queensland. MORETON DISTRICT: Upper Brookfield, Jun 1926, *White* s.n.; Mt Glorious, Jan 1945, *Clemens* s.n. DARLING DOWNS DISTRICT: Emu Vale on T.R. 399, Nov 1950 (BRI 161867); Bunya Mts, Oct 1919, *White* s.n. **New South Wales:** Hastings River District, Sep 1892 *Brown* s.n.; Clarence River, *Wilcox* s.n.; 17 km NNW Dungog, May 1960, *Story* 7330; Terragon, 20 km S of Murwillumbah on Kyogle Road, May 1978, *Jessup* 118.

Common Name: Native Tamarind.

Uses: Acid fruits (aril) have been used for jam making and for acid drinks. Timber is said to be suitable for general indoor work.

In making the combination *Diploglottis australis*, Radlkofer cited it as *D. australis* (Cunn.) Radlk. and cited *Stadtmannia australis* Cunn. as a synonym. Radlkofer intended to base his name on *S. australis* Cunn. In his references to *S. australis* he also cited G. Don, Gen. Syst. 1 (1831) 669. Cunningham's name was published as a synonym without description whereas Don's was validly published and consequently Radlkofer's name has often been cited as *D. australis* (G. Don) Radlk.

The protologue of *Stadtmannia australis* G. Don does not apply to the plant described as *Cupania cunninghamii* (to which Hooker referred *S. australis* Cunn.) and by Radlkofer as *Diploglottis australis*. Radlkofer noted that Don had drawn up his description from a cultivated plant and that Cunningham had not been mentioned by Don. It has been suggested that Don described a young plant with few leaflets but this is unlikely as he described it as a spreading tree and noted that it was propagated by cuttings.

As *Cupania cunninghamii* Hook. and *Stadtmannia australis* G. Don are not conspecific the latter should be disregarded in deciding the correct name for the Australian plant. The combination *D. cunninghamii* (Hook.) Hook.f. based on *Cupania cunninghamii* Hook. must be used instead of *D. australis* Radlk. The last should be regarded as a new name, not as a new combination, as it was based on an illegitimate name.

8. *Diploglottis diphyllostegia* (F. Muell.) F.M. Bailey, Proc. Roy. Soc. Qd 1:148 (1885), Qd Fl. 1:287 (1899). Based on *Cupania diphyllostegia* F. Muell., Fragm. 5:145 (1866).

Ratonia diphyllostegia F. Muell. l.c., pro syn. **Type:** Rockingham Bay, *Dallachy* (not seen).

Diploglottis cunninghamii Hook. f. var. *diphyllostegia* J.F. Bailey, Qd Agric. J. 5:396 (Oct 1899); Domin, Biblioth. Bot. 89:906 (1927).

Diploglottis cunninghamii Hook. f. var. *muelleri* F.M. Bailey, Qd Fl. 1:287 (Dec 1899).

Trees 10–30 m tall and to 30 cm girth; young parts densely hairy with spreading pale rusty villous hairs, young leaves rusty velutinous; branchlets usually fluted, tomentose with pale curly hairs intermingled with long spreading rusty hairs, minutely lenticellate. Leaves with petiole 14–38 (–70) cm long, with 2–9 leaflets

each side of rachis; petioles 3–5 (–11) cm, ribbed, broad at triscutate base, pubescent; rachises ribbed, 3–7 (–21) cm, pubescent; pinnae alternate or subopposite, elliptic-oblong, subobovate-elliptic, oblong or obovate, usually broader above the middle, tips acuminate (usually abruptly and shortly acute-acuminate) or obtuse, sometimes nearly rounded, margins repand, bases oblique, obtuse or acute, 4.5–18.5 (–23) x 2–7.5 (–9.5) cm, glabrous or puberulent on the nerves above, rusty pubescent or puberulent below, semicoriaceous, lateral nerves 14–22 pairs, suboblique; petiolules 2–6 mm, broad at base, pubescent. Thyriform panicles axillary or pseudoterminal, usually clustered at tips of branchlets below velutinous young leaves, mainly polygamo-gynomonoecious, copiously flowered, 14–29 x 2–26 cm, peduncles densely hairy with long spreading crinkly hairs, laxly branched, branches divaricate, slender, ribbed, cymules 4–7-flowered; bracts ovate-oblong, 4–5 x 1 mm, tomentose outside. Flowers 4–5 mm diam., males smaller; pedicels 2–6 mm, pubescent; calyx lobes ovate, 2–2.5 x 1.5–2 mm; petals 4 or 5, if 5 then one slightly reduced and crestless, spatulate, long clawed, 3–3.5 x 2.5 mm, glabrous; scales bilobed, as long as petals, hairy on margins, crests fleshy; disc crescent-shaped or nearly complete, fleshy, glabrous; stamens 8, filaments 2–3 mm, puberulent or glabrescent; ovary villous tomentose, styles stout, glabrous. Capsules yellowish or orange, transversely ellipsoid 3 or 2-sulcate, 0.8–1.7 x 1.5–2.8 cm; or 1-lobed, globose, 1.3–1.7 x 1.4–1.7 cm; lobes subglobose, chartaceous, pale rusty tomentose outside, pubescent inside, aril acidic, orange-yellow enclosing seed.

Queensland, Claudie River to Eungella Range usually at high altitudes (to 800 m) at edge of rainforest or riverside scrubs.

COOK DISTRICT: Claudie River (12°45'S, 143°20'E), Oct 1973, *Hyland* 7001; Annan River, June 1962, *Gittins* 564; S.F.R. 310, Goldsborough L.A. (17°13'S, 145°47'E), Sep 1972, *Moriarty* 1167; Wongabel S.F.R. 191, (17°20'S, 145°28'E), Oct 1975, *Brassell* s.n.; near Atherton (approx. 17°10'S, 145°30'E), Jul 1972, *Beamish* s.n.; S.F.R. 185 Danbulla, Sept 1929, *Doggrell* s.n. NORTH KENNEDY DISTRICT: Jarra Creek, Tully area, Dec 1952, *White* 432; Rockingham Bay, *Bailey* s.n.; Herbert River, *Eaton* s.n.; Strathdickie near Proserpine, Oct 1936, *McPherson* 90. SOUTH KENNEDY DISTRICT: 29 km W of Mackay, Nov 1976, *Turners* s.n.; Eungella Range, Oct 1922, *Francis* s.n. L EICHHARDT DISTRICT: Bee Creek (21°S, 148°E), *Clemens* s.n. (BRI 161710).

Quite a variable species; e.g. specimens from around Eungella Range and Proserpine usually have fewer leaflets which are obovate with obtuse apices.

ATALAYA

ATALAYA Blume, Rumph. 3 : 186 (1847). **Type species:** *A. salicifolia* (A. DC.) Blume, based on *Sapindus salicifolia* A. DC.

Dioecious shrubs or trees. Leaves paripinnate rarely imparipinnate or simple; petioles and rachises winged in some species; pinnae in 1–6 (–10) opposite or alternate pairs, in most species long and narrow, margins entire, coriaceous, lateral nerves usually fine; sessile or petiolulate. Thyriform panicles terminal or in upper axils, usually large and copiously flowered; cymules shortly stalked, dichasial or pleiochasial. Flowers polygamous; pedicellate; bracteate; sepals 5, imbricate, unequal, suborbicular or elliptic-obovate, concave; petals 4 or 5, elliptic-obovate shortly clawed, usually appressed hairy on outside with glabrous apical margin, scales bilobed, rarely minute; crests usually absent (present in one species), or scales provided with slender appendages; discs annular, complete (incomplete in one species); stamens 8, filaments erect, pilose, anthers oblongoid, usually glabrous; ovaries obovoid, 3-lobed, with 1 ovule per locus. Fruits divaricately 3 or 2 (–1)-lobed, apiculate (residual style), separating into indehiscent, 1-seeded dorsally winged samaras; samaras mostly obliquely depressed obovate; wings laterally elongated or ± erect, truncate, obtuse; seeds without an aril.

Eleven species from Africa to E. Malaysia, Papua and Australia; nine (four new) in Australia.

1. Leaves simple, rarely pinnate. Petals densely hairy all over on outside with sericeous white long hairs. 1. *A. sericopetala*
 Leaves pinnate rarely simple (abnormal). Petals usually hairy from above middle to base, apical margin puberulent or glabrous. 2
2. Rachises and petioles broadly winged with leaf-like closely and prominently reticulate wings. Pinnae usually sessile 2. *A. variifolia*
 Rachises and petioles rarely winged (except in juvenile ones), wings if present narrow, not as above. Pinnae petiolulate. 3
3. Pinnae usually linear and long and falcate, more than 4 times as long as wide, 0.3–1.5 cm wide; rachis and petioles often narrowly winged 4
 Pinnae not as above, less than 4 times as long as wide, 1.5–7.5 cm wide; rachis and petiole wingless. 6
4. Pinnae green on both surfaces; glabrous; usually 2 or 4; rachis and petioles often winged. Flowers and fruits glabrous 3. *A. salicifolia*
 Pinnae glaucous especially on lower surface; glabrous or puberulent; 2–17; rachis and petiole sometimes narrowly winged. Flowers and fruits usually hairy 5
5. Pinnae usually 2–4 (rarely –6 or –10), opposite, 6–16 x 0.3–1.5 (–2) cm, usually puberulent below; rachises rarely winged (except in some juvenile ones). Flowers 8–14 mm diam. 4. *A. hemiglauca*
 Pinnae 8–12 (–21), very rarely fewer, opposite or alternate, 1.5–7 x 0.2–0.5 (–1) cm, glabrous; rachises narrowly winged. Flowers 5–9 mm diam. 5. *A. angustifolia*
6. Pinnae usually 1–paired (rarely 2 pairs), obovate or obovate-elliptic-oblong, tips rounded, broad, truncate or retuse; lower surfaces usually glaucous 7
 Pinnae in 2 or 3 pairs (rarely 1 pair), elliptic oblong, subobovate, broadly ovate or narrowly elliptic ovate-oblong, tips obtuse, rounded, or acute; lower surfaces not glaucous 8
7. Pinnae 2–4, with acute or cuneate decurrent bases, glabrous, with numerous prominent oblique lateral nerves. Petals 4, crested; disc incomplete crescent-shaped. Fruits with obliquely oblong spatulate, divaricate, glabrous wings. 6. *A. multiflora*
 Pinnae 2, with very oblique unequal bases; hairy; with few lax lateral nerves. Petals 5, not crested; disc complete, annular. Fruits with oblong cuneate, truncate, hairy wings 7. *A. calcicola*
8. Pinnae long petiolulate (petiolules 1–3.5 cm long); bases unequal, truncate, (cut on one side to second last pair of lateral nerves); surfaces shiny, vernicose, hard and rigid. Peduncles usually very angular. Panicles 25–38 x 24–33 cm with copiously flowered cymules. Flowers large, 8–10 mm diam.; sepals and petals membranous; petals 7–8 x 3.5–4 mm 8. *A. rigida*
 Pinnae shortly petiolulate (petiolules 3–6 mm long); bases oblique obtuse; surfaces not hard and rigid, and shiny. Peduncles not angular. Panicles 10–24 x 13–24 cm, with few flowered cymules. Flowers small, 4.5–6.5 mm diam; sepals coriaceous; petals 4–5 x 1.5–2 mm. 9. *A. australiana*

1. *Atalaya sericopetala* S.T. Reynolds, species nova affinis *A. australiana* foliis plerumque simplicibus et petalis extus omnine sericeis praesertim differt.
Typus: COOK DISTRICT: Morehead River, 102.4 km N of Laura, 6 Sep 1971, A.K. Irvine 53 (BRI holo, QRS iso).

Shrubs or small trees 2–3 m, young parts, peduncles and pedicels finely pubescent with pale rusty hairs; branchlets slightly ribbed, striate, somewhat viscid, lenticellate, pubescent to glabrescent. Leaves simple or paripinnate with 3–4 pairs of leaflets; simple ones elliptic or elliptic-subobovate-oblong, 4.5–17 x 2–8 cm; petioles 0.5–3.5 cm, terete, pulvinate, glabrous; rachises 3.5–7 cm, terete, wingless; pinnae elliptic or oblong-ovate, 8–9.5 x 3.5–5 cm, tips obtuse, margins wavy, bases oblique, obtuse, subequal, puberulent especially below, coriaceous, shiny above, midribs ridged above, usually hairy, lateral nerves 10–26 pairs, reticulation prominent; petiolules 0.8–1 cm, pulvinate. Panicles large, copiously flowered, 8–27 x 2–22 cm, peduncles finely ribbed, ultimate cymules 3–7-flowered. Buds sericeous; flowers cream, 4–6 mm diam. males smaller; pedicels to 2.5 mm long; sepals elliptic-oblong, 2.5–3 x 2 mm, densely sericeous outside; petals 3–3.5 x 1.5–2 mm, densely sericeous hairy over the whole surface on outside, scales bilobed or subentire, densely hairy on margins, crests absent; disc annular, glabrous, often resinous; filaments densely hairy, 2–3 mm long. Samaras 2.5–3.2 cm long, yellow pubescent; wings \pm erect, divaricate, obliquely oblong-cuneate, recurved, to 1.4 cm wide at broadest part, margins subentire.

Northern Queensland from Coen to McLeod River, W of Mossman, in monsoon and riverine forests.

COOK DISTRICT: Coen, Jan 1906, *Garraway* s.n.; 3.2 km S of Bathurst Bay (14° — S, 144° — E), Sep 1970, *Hyland* 4656; Groganville (16°25'S, 144°20'E), Dec. 1974, *Hyland* 7928.

The new species is allied to *A. australiana* from which it differs particularly in the usually simple leaves and petals densely sericeous all over the outer surface.

2. *Atalaya variifolia* F. Muell. ex Benth., Fl. Aust. 1:463 (1863); F.M. Bailey, Qd Fl. 1:300 (1899); Domin, Biblioth. Bot. 89:900 (1927); Radlk., Das Pflanzen. Sapin. 2, 94b:611 (1932). Based on *Thouinia variifolia* F. Muell., Fragm. 1:45 (1858). **Syntypes:** Tropical Australia (Sea Range; Macadam Range; near Fitzmaurice River), *F. Mueller* (none seen).

Small trees 3–8 m; young parts velvety tomentose, branchlets and peduncles slightly ribbed, velvety hairy, lenticellate. Leaves pari- or imparipinnate, often simple with or without lobes, 13–40 cm long including petiole; petioles 3.5–10.5 cm long, broadly winged at apex tapering to base; rachises 3.5–14(–18) cm, with 2–7 sessile or subsessile leaflets; wings of rachis and petiole, oblique, subequal, leaf-like; pinnae subopposite or alternate, variable, mostly narrowly elliptic oblong, apices obtuse, margins entire, repand, bases acute, decurrent, 7–23 x 1.2–2 cm, glabrous or lower surfaces puberulent, coriaceous, midribs ridged above, broad and prominent below; reticulation dense; petiolules to 2 mm long, tumid, often obsolete. Panicles terminal, usually laxly branched and copiously flowered, 10–24 x 6–24 cm. Buds yellow hairy; flowers creamy white, about 5 mm diam.; pedicels 5–7 mm long, villous; sepals ovate-orbicular, 2–3.5 x 1.5–2 mm, membranous, sericeous pubescent outside; petals obovate shortly and abruptly clawed, 6 x 4 mm, pubescent on outside from middle to base, margins ciliolate; scales bilobed with linear appendages, villous; filaments pilose, 5 mm long; ovaries villous. Samaras with ± erect wings, to 5.5 cm long, tomentose; wings depressed obovate, broadest part of wing 1.5–1.8 cm wide, margins crenulate or subentire.

Northern Australia from Weipa to Irvinebank in Queensland, Darwin-Gulf area, Northern Territory and Kimberley Province, Western Australia, in a variety of habitats.

Northern Territory. E. Alligator R., near crossing, Nov 1972, *Byrnes & Martensz* 2820; Oenpelli (12°18'S, 133°4'E), Oct 1948, *Specht* 1265. **Western Australia:** Kimberley Province, Lazarides s.n. **Queensland.** COOK DISTRICT: Weipa, Nov 1969, *Nicholson* s.n.; N of Palmerville (15°39'S, 144°05'E), Nov 1965, *Pedley* 1856; Channel Rd. between Walsh River Crossing & Dimbulah (17°19'S, 145°15'E), Oct 1975, *Hyland* 8466.

3. *Atalaya salicifolia* (DC.) Blume, Rumphia 3:186 (1847); Benth., Fl. Aust. 1:463 (1863); Radlk., Das Pflanzen. Sapin. 2, 98b:609 (1932). Based on *Sapindus salicifolius* DC., Prod. 1:608, n 13 (1824). **Type:** Timor (not seen).

Thouinia australis A. Rich., Sert. Astro. t. 12, 31 (1834). **Type:** Melville Island, *Fraser* (not seen).

Atalaya australis (A. Rich.) F. Muell., Fragm. 1:46 (1858). Based on *Thouinia australis* A. Rich.

Atalaya salicifolia (DC.) Blume var. *intermedia* C.A. Gardner, Bot. Notes Kimberley Div. W.A., 61 (1821). **Type:** Carson River, Sep 1921, *C.A. Gardner* 1556 (PERTH, iso).

Atalaya virens C.T. White, Proc. Roy. Soc. Qd 55:62 (1944). **Type:** Eidsvold, *Dr. T.L. Bancroft* (BRI, holo).

Shrubs to spreading trees with drooping branches 3–10 m; bark grey with transverse ridges; young parts puberulent; branchlets pale with minute lenticels. Leaves paripinnate with 1–2(–3) pairs of leaflets, 2–18 cm long including petiole; petioles 1.5–6(–8) cm, pulvinate; rachises 1–3(–9) cm long, rachises and petioles usually narrowly winged; pinnae opposite, narrowly elliptic-oblong or obovate-

oblong, obtuse or subacute at apices, acute at bases, 4.5–8.5 x 0.7–1.8 cm (juveniles to 16 x 4 cm), glabrous rarely puberulent, green on both surfaces, shiny above; lateral nerves 11–14 pairs, fine; petiolules 1–5 mm long, pulvinate, subglabrous. Panicles terminal or axillary, laxly branched, 8–26 cm long and to 16 cm wide, peduncles puberulent to glabrous; bracts to 1 mm long. Buds usually glabrous; flowers 7–10 mm in diam.; pedicels 4–7 mm, subglabrous; sepals 2–3 x 1.5–3 mm, glabrous; petals obovate, abruptly shortly clawed, 5–7 x 2.5–3.5 mm, puberulent towards the base outside, scales bilobed as long as petals, hairy, with 2 slender appendages; discs annular, glabrous; filaments pilose, 3–3.5 mm long; ovaries 2 or 3-lobed, slightly villous hairy on angles otherwise glabrous. Samaras glabrous, with \pm divaricate, falcate obovate-oblong wings, 2.5–3.5 cm long, broadest part of wing to 2 cm wide.

From Timor to Torres Strait, northern Queensland to as far south as Richmond River, New South Wales; also in Northern Territory and Western Australia. In dry rainforests on stony soil, usually on hillsides.

Timor: South, Middle Timor, alt. 700 m (BRI 244164). **Western Australia:** Carson River, Sep 1921, Gardner s.n. (PERTH); Careening Bay, Oct 1820, *Cunningham* (K). **Queensland:** COOK DISTRICT: Torres Straits, S.E. of Prince of Wales Island, off Packe Is., Feb 1975, *Cameron* 20107 & 20108; about 3.2 km S.E. of Coen, to N of Port Stewart Rd, Oct 1962, *Smith* 11990. NORTH KENNEDY DISTRICT: Kinrara (18°30'S, 145°3'E), Nov 1941, *Blake* 14443. PORT CURTIS DISTRICT: Butlerville via Mt Larcom, Oct 1962, *Roffe* s.n. LEICHHARDT DISTRICT: Gogango Ra near Edungalba, Sep 1943, *Blake* 15347. WIDE BAY DISTRICT: Biggenden, Oct 1930, *White* 7337. BURNETT DISTRICT: Goodnight scrub about 65 km SW of Bundaberg, Jun 1957, *Smith* 9855. MORETON DISTRICT: Blackbutt Ra (26°S, 152°E approx.), Dec 1968, *Trapnell & Williams* s.n.; between Lake Moogerah and Boonah, Sep 1977, *Jessup* 10. **New South Wales:** Reported from Lismore to Warialda. Kyogle, Dec 1942, *King* s.n.

Common name: Whitewood.

4. *Atalaya hemiglauca* (F. Muell.) F. Muell. ex Benth., Fl. Aust. 1:463 (1863); F.M. Bailey, Qd Fl. 1:300 (1899); Domin, Biblioth. Bot. 89:900 (1927); Radlk., Das Pflanzen. Sapin. 2,98b:610 (1932). Based on *Thouinia hemiglauca* F. Muell., Fragm. 1:98 (1863). Types: Mt Murchison,? *Dallachy & Goodwin* (not seen); N.W. Coast, *Bynoe* (K); Hammersley Range, Nichol Bay, *F. Gregory* (MEL 74649); Rockhampton, Canoona Rd, *Thozet* (MEL 74650); Albert River, *Henne* (MEL 74651); Moonie River, *Mitchell* (K); Liverpool Plains, May 1925, *A. Cunningham* (K)

More or less glaucous small trees, 3–6m; young parts puberulent; branchlets striate, lenticels minute. Leaves paripinnate with 1–3(–6) pairs of leaflets, rarely leaves simple and broad, ovate; petioles 0.8–4.5 cm, terete, pulvinate, usually wingless, subglabrous or glabrous; rachises 1.2–4.5(–8.5) cm long, winged only in juvenile leaves, then to 18 cm long; pinnae opposite, elongate, narrowly elliptic-obovate or oblong-ovate or linear-oblong, usually falcate, tips obtuse or subacute, bases usually acute, 6–16(–20) x 0.3–1.5(–2) cm, glabrous or with short appressed puberulence, coriaceous, dull bluish-green, drying glaucous below; petiolules 1–5 mm long, pulvinate. Panicles terminal or axillary, laxly branched, 6–18(–23) cm long and as wide, peduncles puberulent or glabrous; bracts 2–3 x 1.5 mm, ovate. Buds sericeous; flowers white, fragrant, 0.6–1 x 1–1.4 cm; pedicels 2.5 mm long, puberulent; sepals obovate, 2.5–5 x 2–3 mm, pubescent to glabrous; petals obovate shortly clawed, to 8 x 3.5 mm, sericeous especially towards the base on outside, margins glabrous; scales bilobed, crestless, villous; filaments 2.5–4 mm long, pubescent; ovaries usually velvety hairy. Samaras with usually \pm erect wings, 2.1–3.8 cm long, tomentose to puberulent with appressed hairs; wings depressed obovate, truncate with crispate or crenate margins, 1–1.3 cm wide at broadest part.

A widespread inland species in all states except Victoria and Tasmania, common in tropical Queensland, Northern Territory, Western Australia, western New South Wales and South Australia, growing in a variety of soils in dry open mixed forests, edges of brigalow scrubs and deserts.

Northern Territory: Argadargarda S.R., 18 bore, Sep 1954, *Chippendale* s.n. (NT 298); 32 km W of Katherine, Sep 1961, *Speck* 1663; 18.7 km N of Daly Waters P.O., Sep 1957, *Chippendale* s.n. (NT 3748); 112 km SE Ringwood Homestead, Simpson Desert, Oct 1954, *Winkworth* 633. **Western Australia:** Round Kununurra-Ord Dam and Wyndham Rd, Sep 1970, *Scarth-Johnson* 536; 11.2 km S of Derby, Sep 1959, *Lazarides* 6585; Halls Creek, Sep 1970, *Scarth-Johnson* 578. **Queensland:** COOK DISTRICT: about 32 km WNW of Chillagoe, Nov 1965, *Pedley* 1825; 3 km E of Inverleigh on Normanton Rd, Oct 1977, *Irvine* 1871; Lyndhurst Station Einsleigh River, Sep 1937, *Brass & White* 335. NORTH KENNEDY DISTRICT: about 96 km S of Mt Garnet and 80 km W of Ingham, Oct 1967, *Morain* 130; Lower Burdekin River, 1962, *Wyatt* 16. BURKE DISTRICT: Hughenden, Oct 1935, *Blake* 9991; Mt Isa, Oct 1974, *Specht & Rogers* 68 & 137; Doomadgee Mission, *Whitehouse* s.n. LEICHHARDT DISTRICT: Boot Hill Ck about 70 km SW of Sarina, Apr 1970, *Williams* s.n.; Mt Playfair about 96 km ESE of Tambo, Oct 1963, *Biddulph* s.n. MITCHELL DISTRICT: 48 km NE of Longreach, Sep 1967, *McCray* s.n.; Blackall, Oct 1937, *Everist* 1563. GREGORY NORTH DISTRICT: Between Glenormiston and Toko Ranges, Jan — Feb 1935, *Boyle* s.n.; 19 km NNW of Pathunga (22°12'S, 140°34'E), Sep 1977, *Purdie* 1028. SOUTH KENNEDY DISTRICT: 120 km N of Belyando River, Aug 1973, *Trapnell & Williams* 68. PORT CURTIS DISTRICT: Between St. Lawrence & Marlborough, Oct 1937, *White* 12093; 2 km S of Rosewood Homestead, Feb 1964, *Speck* 1808. DARLING DOWNS DISTRICT: Between Meandarra and Westmar, Nov 1958, *Pedley* 334; MARANOA DISTRICT: Murilla, 14.4 km NW of Glenmorgan, Nov 1958, *Johnson* 636; Gubberamunda near Roma, Oct 1930, *Jensen*, s.n. WARREGO DISTRICT: Oakwood Station, about 80 km N of Charleville, Oct 1940, *Smith & Everist* 869; About 48 km NNE of Thargomindah along road to Quilpie, Nov 1954, *Smith* 6067. **South Australia:** Stevenson River about 10 km E of Pedirka, Sep 1932, *Ising* s.n. **New South Wales:** Warrumbungle — Toorawenah Rd, Dec 1973, *Streimann* s.n.; Monolon Station, 48 km ESE of Milparinka, Oct 1963, *Constable* 4591.

A very variable species in density of indumentum of leaves and flowers; width of leaflets and length of petiolules e.g. *Specht & Rogers* 68 & 137, *Irvine* 1871, and *Purdie* 1028, like type from Albert River (Burke District) *Henne* have very narrow leaflets which are linear-ovate-oblong, falcate, 3—5 mm wide and about 20—30 times as long as wide; subsessile; glabrous; flowers also glabrous. Glaucousness also varies with age.

Common Name: Whitewood.

Uses: The plant is regarded as a very good fodder tree. Its toxicity has been the subject of considerable investigation; field evidence suggests that it can cause staggers in sheep, cattle and horses (*Everist* 1974).

5. *Atalaya angustifolia* S.T. Reynolds species nova *A. hemiglaucæ* proxima a qua praecipue differt foliolatis parvioribus angustis et plerumque pluribus (4—11 paribus). **Typus:** Cook District: 107.2 km S of Laura (15°40'S, 144°30'E), 17 Sep 1971, *A. Irvine* 79 (BRI holotypus, QRS isotypus).

Shrubs or small trees 0.5—4 m; young parts pubescent; lenticellate. Leaves paripinnate with (1—)4—6(—11) pairs of fine narrow leaflets, 9.5—17 cm long including the petiole; petioles 1—3.5 cm, slender, pulvinate, often winged; rachises 2—11 cm, adaxially ridged, narrowly winged; pinnae subsessile or sessile, opposite or alternate, narrow, linear-obovate or linear elliptic-oblong, falcate, apices obtuse or subacute, apiculate, bases attenuate, acute, 1.5—7 x 0.2—0.5(—1) cm, glabrous, drying paler below; lateral nerves and reticulations very fine; petiolules to 1 mm long, tumid, often obsolete. Panicles terminal, copiously flowered, 13—25 x 3—10 cm, peduncles slender, usually pubescent. Flowers creamy white, 5—9 mm diam., females larger; pedicels 3 mm long, pubescent; sepals obovate, orbicular or elliptic, usually thin, 2.5—5 x 2 mm, sericeous pubescent outside with glabrous margins; petals subobovate-orbicular shortly clawed, 4.5—7 x 2—3 mm, hairy outside from middle to base, margins ciliolate; scales bilobed, densely hairy, with 2 slender appendages; discs annular, fleshy, glabrous; filaments pilose, 2.5—3 mm long; ovaries trigonous, villous tomentose, styles short. Samaras with divaricate or suberect wings, velvety tomentose, 2.5—4.2 cm long; wings obliquely oblong-cuneate, subtruncate, 1.1—2 cm wide at broadest part, margins crispate.

Northern Queensland around Cooktown and Laura; in open woodlands or dry scrubs, usually on quartz gravel.

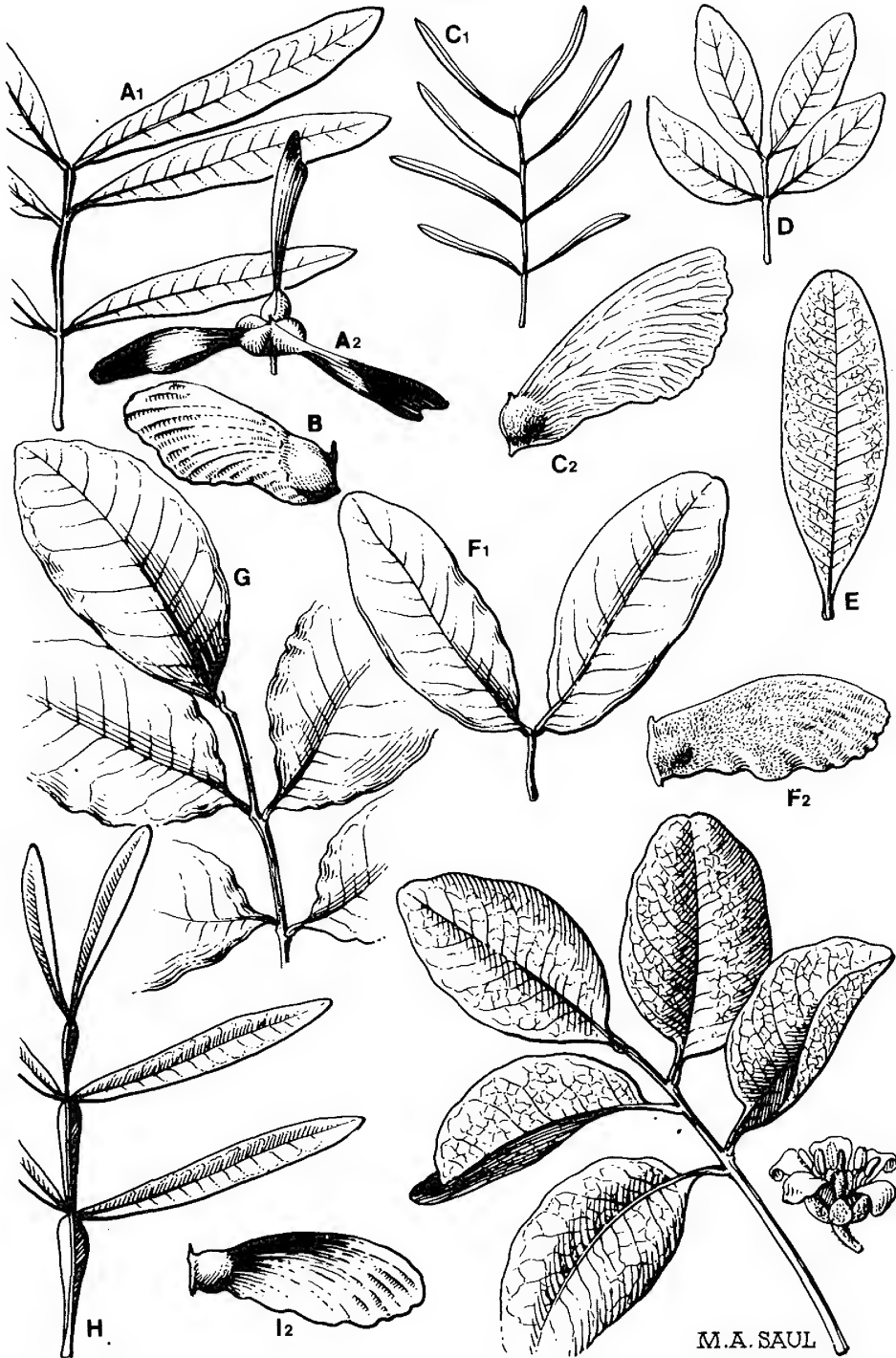


Figure 27. *Atalaya*. A. *A. salicifolia*. A1. Leaf. A2. Fruit. B. *A. hemiglaucæ*, fruit. C. *A. angustifolia*. C1. Leaf. C2. Fruit. D. *A. multiflora*, leaf. E. *A. sericopetala*, leaf. F. *A. calcicola*. F1. Leaf. F2. Fruit. G. *A. ausraliana*, leaf. H. *A. variifolia*, leaf. I. *A. rigida*. I1. Leaf. I2. Fruit. I3. Flower.

Cook District: Kennedy River, Oct 1969, *Webb & Tracey* s.n.; Annan River about 8 km SSW of Cooktown, Aug 1959, *Smith* 10759; 99 km W of Cooktown, Aug 1966, *Story* 7968.

The new species is closest to *A. hemiglauc*a but differ chiefly in having smaller, narrow and usually more leaflets (4–11 pairs).

6. *Atalaya multiflora* Benth., Fl. Aust. 1:463 (1863); F.M. Bailey, Qd. Fl. 1:300 (1899); Domin, Biblioth. Bot. 89:900 (1827); Radlk., Das Pflanzen. Sapin. 2, 28b:607 (1932). **Type:** Brisbane River, *F. Mueller*, Dec 1856 (MEL 74652 lectotypus novus); *W. Hill & F. Mueller*, 1858 (K, syntype).

Pseudatalaya multiflora Baill., Nat. His. Pl. 5:419 (1874) based on *Atalaya multiflora* Benth.

Small trees; young parts pubescent; branchlets slightly ribbed with minute pale lenticels especially in grooves. Leaves paripinnate with 1–2(–3) pairs of leaflets, 4.5–16 cm long, including petiole; petioles 1–4.5 cm, semiterete, pulvinate; rachises 1–2.5(–6) cm, semiterete, winged in juveniles; pinnae opposite, oblong or obovate-elliptic or obovate, apices broad, truncate or retuse, bases cuneate, acute, decurrent into petiolules, or obtuse, usually oblique, 4–9.5(–11.5) x 1.5–4.5(–7.5) cm, glabrous, coriaceous, upper surfaces glossy, drying dark reddish brown, lower ones paler; lateral nerves subpatent or oblique, nerves and reticulations raised and prominent especially below; petiolules 2–6 mm long, tumid, pulvinate. Panicles terminal or in upper axils, copiously flowered with densely flowered cymes, 4.5–17(–25) x 5–14 cm, peduncles puberulent; bracts ovate 1.2–5 mm long. Buds sericeous; flowers white, 7 mm diam; pedicels 5–6 mm long, pubescent; sepals broadly obovate, 3–3.5 x 2–5 mm, semicoriaceous, sericeous pubescent outside except the margins; petals obovate, clawed, 6 x 3 mm, inside glabrous except densely hairy crested scale, puberulent on claw outside; disc unilateral, glabrous; filaments 4–5 mm long, pilose; ovaries villous at the upper angles, glabrous elsewhere. Samaras with somewhat divaricate oblong cuneate wings, 3.5 cm long, subglabrous, broadest part of wing to 1.4 cm wide.

Queensland, from Proserpine to near Beechmont. Quite rare, has not been collected since 1943.

NORTH KENNEDY DISTRICT: Kelsey Creek, Proserpine, *Thorogood* s.n. PORT CURTIS DISTRICT: Rockhampton, *Higgins* s.n. WIDE BAY DISTRICT: Imbil, Dec 1943, *Clemens* s.n. MORETON DISTRICT: Pedwells Scrub near Samford, Jul 1925, *Francis* s.n.

7. *Atalaya calcicola* S.T. Reynolds, species nova, a speciebus ceteris Australianis pari uno foliorum basibus valde inaequalibus et paginis plerumque pubescentibus.

Typus: Cook District: Chillagoe-Alma-den road 5 km from Chillagoe, 10 Mar 1980, *Simon & Clarkson* 3596 (BRI holotypus).

Trees 7–10 m; young parts pale rusty tomentose; branchlets ribbed, velvety with dense crispate hairs intermingled with long simple hairs; young leaves with silky long hairs. Leaves bifoliate; petioles 1–2.5 cm, isobilateral, tomentose; pinnae opposite, obovate-elliptic with very unequal, subfalcate base, (acute on one side, obtuse and cut to second or third pair of basal lateral nerves on other), tips obtuse emarginate, 6–14 x 2.8–5.5 cm, surfaces pubescent or puberulent with appressed long hairs, midribs tomentose, upper surfaces drying darker, lower ones usually glaucous; lateral nerves 8–10 pairs, lax, reticulations also lax; petiolules 2–4 mm, semiterete, pulvinate, tomentose. Panicles terminal or axillary, laxly branched and flowered, 4–10 cm long and as wide, peduncles densely hairy with both crispate and long spreading hairs. Flowers white, 7 mm diam.; pedicels 5 mm long, tomentose; sepals broadly ovate, ± membranous, 3–4 x 2.5–3 mm, white hairy outside; petals obovate shortly and abruptly clawed, 6 x 2.5 mm, rusty hairy outside, membranous, margins ciliate, recurved at base with small bilobed or rudimentary hairy scale,

crests absent; disc annular, glabrous; filaments pilose, 3 mm long; ovaries densely villous. Samaras with laterally elongate divergent wings 3.2–5.5 cm long, white tomentose hairy, wings cuneate-oblong, broad, blunt, with wavy crispate margins and apex, broadest part of wing 1.4–4 cm wide.

Northern Queensland, restricted to limestone outcrops around Mungana-Chillagoe and Almaden, usually growing in deciduous vine thickets.

COOK DISTRICT: 6.4 km N of Mungana (approx 17°05'S, 144°25'E), May 1970, *Webb & Tracey* 10197; Chillagoe, in 1962, *Webb & Tracey* 8028; Almaden-Chillagoe Rd about 5 km from Chillagoe (17°10'S, 144°32'E), Aug 1973, *Moriarty* 1448.

This species differs from other Australian species in having only one pair of leaflets with every unequal bases and their surfaces usually pubescent.

8. *Atalaya rigida* S.T. Reynolds, species nova. Foliola respectu formae accendentia ad *A. australianam* sed respectu texturae dura rigidaque; et flores grandiores sunt. **Typus:** North Kennedy District: Strathdickie North, near Proserpine, Oct 1937, *K.A. Macpherson* 123 (BRI holotypus, QRS isotypus).

Small upright trees, seldom branched; young parts pubescent; branchlets ribbed, minutely pubescent or puberulent with short hairs; lenticels pale. Leaves paripinnate, 15–19 x 16–23 cm; petioles 2–5.5 cm, terete, trisulcate and pulvinate at base; rachises 3.5–14 cm long, subterete, adaxially ridged, wingless, finely puberulent with 2–4 leaflets on each side; pinnae alternate, broadly ovate or elliptic, tips obtuse, bases subequal, truncate cut on one side to second last pair of lateral nerves, oblique (often obtuse one side and truncate on the other), 10–14.5 x 5.5–7.5 cm, glabrous, thickly coriaceous, usually hard, rigid, shiny and vernicose above, pale below; lateral nerves 8–11 pairs, straight, arched at tips, reticulations dense, prominent; petiolules semiterete, channelled above, 1–3.5 cm, pubescent. Panicles terminal or subterminal, densely flowered, 25–38 x 24–33 cm; peduncles usually very angular, slightly ribbed, minutely pubescent, cymes copiously flowered; bracts 2 mm long, ovate. Buds-hoary; flowers (female) white, 8–10 mm diam.; petioles 4–6 mm long, tomentose; sepals obovate, 3–3.5 x 2 mm, membranous, hoary pubescent; petals 7–8 x 3.5–4 mm, obovate-oblong, shortly abruptly clawed, white pubescent towards the base and thinning towards apex on outside; scales bilobed, densely villous, crestless, often with slender appendages; disc annular, glabrous; filaments 5 mm long, pilose; ovary trigonous, villous. Samaras with laterally elongate very divaricate wings 3.5–3.8 cm long, pubescent; wings oblong-spathulate, rounded at apex, puberulent or glabrous, to 1.3 cm wide at broadest part, margins subentire.

Queensland, Proserpine area to Mackay.

NORTH KENNEDY DISTRICT: Cannonvale area, in 1976, *Wynne* 25; South Molle Island, Nov 1954, *Fielding* s.n. SOUTH KENNEDY DISTRICT: Mackay, Dec 1938, *MacArthur* s.n.

The leaflets of this species approach those of *A. australiana* with respect to shape but the texture is hard and rigid and the flowers are larger.

9. *Atalaya australiana* Leenh., *Blumea* 13:126 (1968). Based on *Sapindus ? australis* Benth., *Fl. Aust.* 1:464 (1863); F.M. Bailey, *Qd Fl.* 1:301^f (1899). **Type:** Cape York, Voy. of Rattlesnake, Bot. 489, 27 Oct 1849, *J. MacGillivray* (K, holo). *Atalaya australis* (Benth.) Radlk., *Sitzungsber. bayer. Akad.* 8:298, n 11, 327 (1878) nom. illeg. non (A. Rich.) F. Muell., *Fragm.* 1:46 (1858); F. Muell., *Syst. Census* 24 (1882) & ed 2:41 (1889); Domin, *Biblioth. Bot.* 89:900 (1927); Radlk., *Das Pflanzen. Sapin.* 2, 98b:608 (1932). Based on *Sapindus australis* Benth., l.c.

Misapplied name: *Atalaya multiflora* Benth., l.c. 463 (1863) p.p. quoad specimens ex Cape York, Oct 1948 *J. MacGillivray*, & Trinity Island, 4 Jul 1848, *J. MacGillivray* (K).

Trees 6–20 m; younger parts, branchlets and peduncles finely pubescent with short straight yellowish hairs; branchlets ribbed with linear lenticels often in the grooves. Leaves 14–25(–32) x 14–20(–36) cm, paripinnate with (1–)2 or 3 pairs of leaflets; petioles 2.2–5.5(–6.5) cm, semiterete, pulvinate and often lenticellate at base, puberulent to glabrous; rachises 1–8(–11.5) cm, bisulcate above, wingless, pubescent or subglabrous; pinnae opposite or alternate, elliptic-oblong, obovate-elliptic or narrowly elliptic-subovate-oblong, tips rounded, obtuse or acute, margins repand, bases usually oblique, acute, or broad and unequal, 6–14(–21) x 1.7–6.5(–7.8) cm, glabrous or lower surfaces subglabrous, often thinly coriaceous; lateral nerves 10–16 pairs, usually patent, nerves and reticulations fine, prominent; petiolules 3–6 mm long, semiterete, often channelled above, pulvinate, pubescent with pale rusty hairs or glabrescent. Panicles terminal, laxly branched and flowered, 10–24 x 13–24 cm, peduncles with pale yellow hairs, cymules few flowered. Buds hoary; flowers cream, 4.5–6.5 mm diam.; pedicels 3–5 mm long, tomentose; sepals elliptic oblong or ovate-elliptic 2–3.5 x 1–2 mm, coriaceous, sericeous or white hairy on outside, apical margin less hairy or glabrous; petals oblong-obovate shortly clawed, 4–5 x 1.5–2 mm, densely appressed hairy on outside from above middle to base with white hairs, margins ciliolate, scales bilobed, densely hairy; disc annular, glabrous; filaments 3 mm long, pilose; ovaries villous. Samaras with \pm divaricate wings, 2.5–3.7 cm long, pubescent; wings recurved, falcate obovate-spathulate, rounded at apex, puberulent, margins crenulate or subentire towards apex, to 1.2 cm wide at the broadest part (apex).

Northern Queensland from Torres Strait to near Proserpine; usually in beach scrubs or strand forests, also monsoon forests in hilly country.

COOK DISTRICT: Kubin Village, Banks (Moa) Is, Torres Strait, Aug 1975, *Cameron* 2474 (QRS); Bamaga, Galloways Creek, in 1962. *Webb & Tracey* 7108; Red Island Point about 25 km SW of Cape York, Sep 1963, *Jones* 2478; Oct 1965, *Smith* 12550. NORTH KENNEDY DISTRICT: 23.6 km N Proserpine P.O., Sep 1977, *Guymer* 1117 (NE).

JAGERA

JAGERA Blume, *Rumphia* 3:155 (1847) **Type species:** *J. speciosa* Blume, *nom illeg.* (*J. javanica* (Blume) Blume ex Kalman, based on *Garuga javanica* Blume).

Trees with saponin in bark, twigs, leaves and pericarp; branchlets usually ribbed towards the tip, densely rusty hairy or glabrous. Leaves mostly whorled at tips of branchlets, paripinnate; pinnae usually narrowly ovate-oblong subfalcate, serrate, serrulate or entire at margins, midrib usually excentric, surfaces pellucid punctate. Inflorescences thyrsiform, often clustered at tips of branchlets in axil of young leaves or fallen leaves, polygamo-androdioecious or -andromonoecious, peduncles ribbed, cymules shortly stalked, 2–7 flowered. Flowers small; pedicels articulate towards base; calyces 5-lobed, lobes ovate, imbricate; petals 5, as long as calyx, clawed, with 2 hairy crested scales; disc annular, glabrous; stamens 7–9, usually exerted; filaments pilose, anthers oblongoid-obovoid, glabrous or margins sometimes puberulent; ovaries sessile, densely setose hairy, 3 or 4-locular, style short. Capsules subglobose, ellipsoid or oblongoid, usually obscurely 3 or 4-sulcate, apiculate, densely rusty setose hairy, 3 or 4-valved; valves woody, verrucose and densely hairy outside with short hairs intermingled with long setose irritant hairs, villous inside; seeds mostly solitary in each cell, obovoid with small basal, cupular aril.

Four species from East Malaysia to New Guinea and Eastern Australia; three (one new and one new record) in Australia.

1. Leaves discolorous, whitish below; leaflets elliptic or elliptic-ovate, entire, 7.5–18.5 x 3–5 (–6.5) cm; petiolules 8–14 mm long. Panicles in upper axils or in axil of fallen leaves or ramiflorous..... 1. *J. discolor*

- Leaves not discolorous; leaflets usually obliquely oblong-ovate, subfalcate, (1.5—) 2.5—17.5 x 0.5—5 cm; petiolules 1—5 mm long. Panicles axillary, in upper axils or clustered at tips of branchlets in axil of and below densely hairy very young leaves and bracts. 2
2. Pinnae 8—18 (—20) in number, 2.5—11.5 x 1—3 cm. Panicles 7—25 x 2.2—16 cm, usually laxly branched or unbranched. Branchlets mostly slender, densely rusty hairy to glabrous. (Leaves with petiole (8.5—) 17—27 (—35) cm long). 2. *J. pseudorhus*
- Pinnae 19—24 in number, 6—17.5 x 2—5 cm. Panicles large, 22—36 x 14.5—19 cm, much branched and copiously flowered. Branchlets stout, fluted, velutinous. (Leaves with petiole 35—51 cm long) 3. *J. serrata*

1. *Jagera discolor* L.S. Smith ex S.T. Reynolds, species nova differt a ceteris foliis satis grandibus ellipticis marginibus integris et paginis infernis albescentibus praeditis. **Typus:** Cook District: Clump Mountain, 7 Nov 1951, L.S. Smith 4977 (BRI holotypus).

Trees to 25 m high and to 45 cm girth, buttressed; young parts densely rusty hairy; branchlets, petioles, rachises and petiolules with minute appressed rusty tomentum later glabrous; branchlets rounded usually ribbed towards the tip, with numerous pale ellipsoid lenticels especially in the grooves. Leaves discolorous, with petiole 19—42 (—54) cm long, with 3 or 4 (—6) leaflets on each side of rachis; petioles 7.5—10.5 (—14) cm, subterete, pulvinate at broad base, lenticellate; rachises 4.5—20.5 (—53 cm in juveniles) cm, subterete, grooved above, striated below, usually lenticellate; pinnae alternate or subopposite, elliptic or elliptic-ovate and oblique or subovate-oblong, tips abruptly and shortly acuminate or acute, margins entire, bases obtuse or acute, unequal, 7.5—15.5 (—18.5) x 3—5 (—6.5) cm, glabrous above, finely pubescent or puberulent below, lower surfaces papillose, greyish or drying whitish; midribs grooved above, lateral nerves 7—12 pairs, obliquely arched and ascending, usually drying reddish; petiolules 8—16 mm long, decreasing in size towards the tip, subterete, channelled above. Thyrsiform panicles, polygamodioecious, axillary, in upper axils or in axils of fallen leaves, sometimes ramiflorous, 9—14 x 6—8 cm, branching from the base, peduncles densely minutely rusty hairy, ribbed, branches racemiform, slender, divaricate; bracts ovate, 1—3 (—5) mm long. Buds subglobose; flowers 4—5.5 mm diam; pedicels 2—4 mm long, pubescent; calyx lobes subequal, oblong-ovate, obtuse, 1—3 x 1.5—2 mm, tomentose outside; petals subspathulate or obovate or suborbicular abruptly contracted into a long claw, crenate or toothed at apex, 2.5 x 2 mm; scales equal, often missing, hairy, crests if present usually small (often absent in females); stamens 7—9, filaments 1.2—3 mm (males longer), pilose, anthers glabrous, 0.5 x 0.3 mm, (usually warty in females); ovaries densely setose hairy and often echinate; styles stout. Capsules reddish with dense rusty setose hairs, trigono-globose, carinate at angles, 1.2—1.6 x 1.2—1.8 cm; 3-valved, valves drying somewhat woody, densely pale villous hairy inside; seeds shiny, brownish.

North Queensland from Mt. Lewis to Mt. Fox and Hinchinbrook Island and also in New Guinea, in high altitude rain forests in mountainous country usually as an understory tree.

New Guinea. NEW BRITAIN: Mt Talawe, Western slope above Tia, Talasea, May 1966, *Frodin* s.n. (NGF 26792). MOROBE DISTRICT: Ridge near Kui village, Oct 1965, *Gillison* s.n. (NGF 25007). **Queensland:** COOK DISTRICT: Mt Lewis Exp. E/P 18, North Mary L.A. R 143 (16°30'S, 145°16'E), Sep 1973, *Sanderson* 436 (QRS); Copper Lode Falls Dam area, Cairns, Dec 1973, *Birch* 59; R 756, East Downey L.A. (17°40'S, 145°50'E), Nov 1971, *Risley* 28. NORTH KENNEDY DISTRICT: Mt Fox, Oct 1949, *Clemens* s.n.; Moomin, S.F.R. 99, Aug 1953, *White* s.n.

The new species differs from the rest in having fairly large elliptic leaflets with entire margins and whitish lower surfaces.

2. *Jagera pseudorhus* (A. Rich.) Radlk., Sap. Holl. — Ind. 37 (107) (1877); Domin., Biblioth. Bot. 89:906 (1927); Francis, Aust. Rain-For. Trees, ed 3:256 (1970). Based on *Cupania pseudorhus* A. Rich., Sert. Astrolab. 34, f.14 (1834); Benth.,

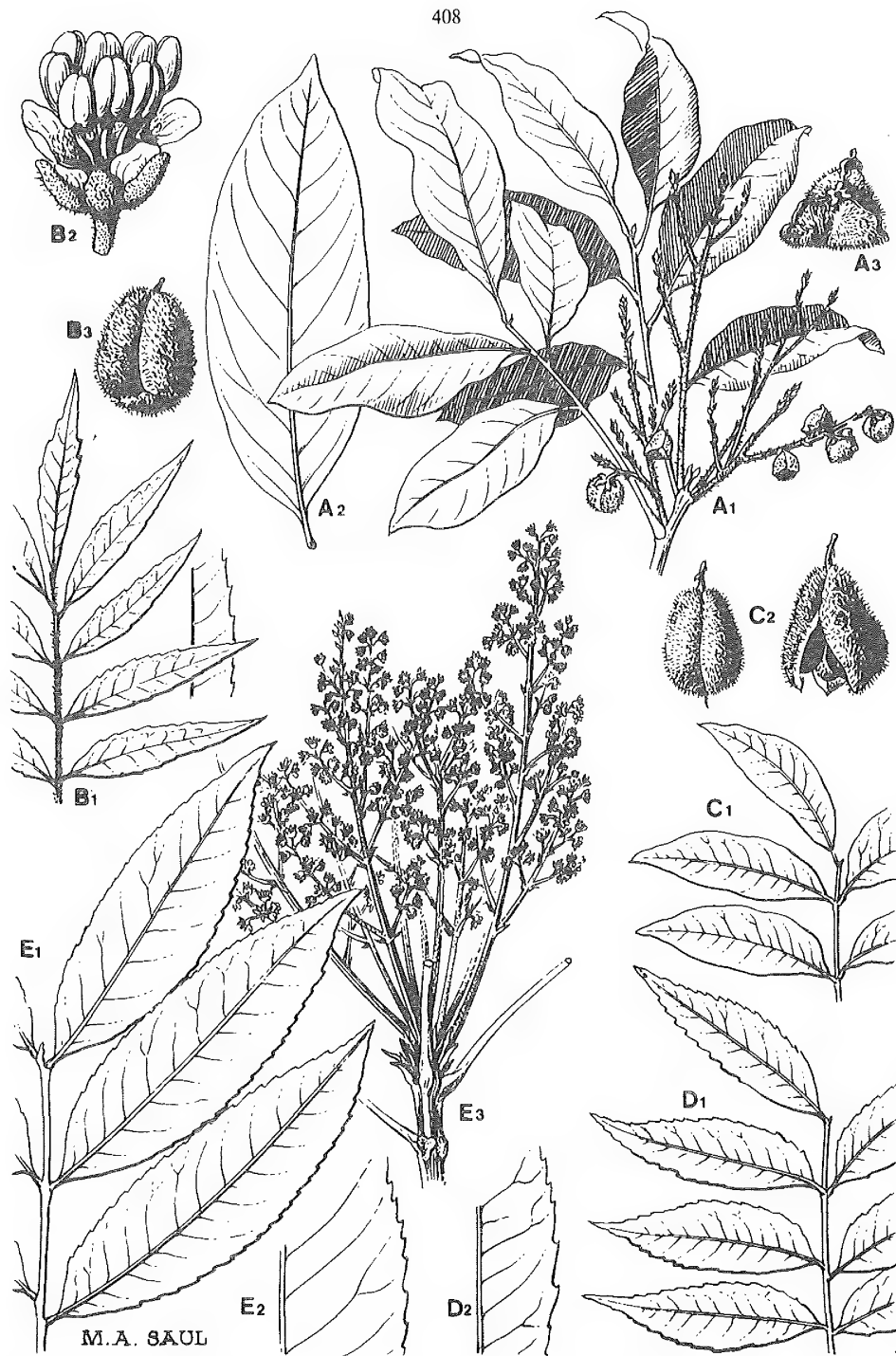


Figure 28. *Jagera*. A. *J. discolor*. A1. Fruiting branch. A2. Leaflet ($\times \frac{1}{2}$). A3. Fruit ($\times 1$). B. *J. pseudorhus* f. *pseudorhus*. B1. Upper part of leaf ($\times \frac{1}{2}$). B2. Flower ($\times 6$). B3. Fruit ($\times 1$). C. *J. pseudorhus* var. *integerrima*. C1. Upper part of leaf ($\times \frac{1}{2}$). C2. Fruit ($\times 1$). D. *J. pseudorhus* f. *pilosiuscula*. D1. Upper part of leaf ($\times \frac{1}{2}$). D2. Leaf margin ($\times 1$). E. *J. serrata*. E1. Upper part of leaf ($\times \frac{1}{2}$). E2. Leaf margin ($\times 1$). E3. Inflorescence ($\times \frac{1}{3}$).

Fl. Aust. 1:459 (1863); F. Muell., Fragm. 9:92 (1875); F.M. Bailey, Qd. Fl. 1:292 (1899). **Type:** Hastings River, Port Macquarie, *Fraser* (not seen).

Cupania setigera Cunn. ex Heynh., Nomencl. 1:239 (1840). **Type:** Moreton Bay, *A. Cunningham* (not seen).

Trees 4–10 m, often spreading; young parts usually densely villous hairy; branchlets usually slender, ribbed towards tip, densely rusty hairy to glabrous. Leaves clustered at tips of branchlets, with petiole (8.5–)17–27(–35) cm long with 4–10 leaflets each side of rachis; petioles 1.5–12 cm, subterete, trisulcate at broad base, hairy or glabrous; rachises 8.5–18 (–26) cm subterete, densely villous to glabrous; pinnae opposite to alternate, obliquely elliptic- or oblong-ovate, often falcate, acute or acuminate at apices, margins serrate, serrulate or entire, bases unequal, oblique, obtuse or acute, (1.5–) 2.5–11.5 x 0.5–3.2 cm, glabrous or puberulent above, pubescent to glabrous below, semicoriaceous, shiny above; midrib excentric, reticulation usually prominent; petiolules 1–3 mm long. Panicles usually clustered at tips of branchlets below very young densely rusty villous leaves or in upper axils, 4.5–25 x 4–16 cm, peduncles densely rusty tomentose to puberulent or glabrous; cymules 2–7 flowered; bracts linear ovate-oblong or subulate 2.3–8 x 1.5 mm. Flowers 4–6 mm diam.; pedicels 2–6 mm long; calyx lobes 2–2.5 x 1.5 mm, hairy or glabrous outside; petals obovate, clawed, 3 x 2 mm, scales broad, densely hairy on margins, crests slender or clavate and fleshy; stamens 8–10, exerted, filaments subulate, 2–6 mm long, anthers oblong-obovoid, 2–2.5 x 1.2 mm, glabrous or margins villous; ovaries oblong-ovoid, usually 3–grooved, densely setose hairy, style to 3 mm long. Capsules ellipsoid, obovoid or oblongoid, 3 or 4 sulcate, 1.4–1.8 x 1.2–1.5 cm, 3 or 4 valved, densely hairy outside with brown setose irritant hairs, villous inside; septa thick; seeds ellipsoid, dark brown with basal aril.

New Guinea and eastern Australia. Most common at edge of rainforests, along creek and river banks on alluvial and basaltic soils.

Common Name: Foam Bark Tree or Fern Tree, also known as Pink Tamarind.

Uses: Trees are quite ornamental and are said to be used for honey production. Timber is light pinkish brown, close grained and has been suggested for tool handles. The bark contains large amounts of saponin and has been used as a foaming agent in lieu of soap by the natives of New Guinea. The bark is also used as a fish poison by aborigines.

A very polymorphic species. Two varieties and several forms are distinguished here with the extreme forms merging into the other.

1. Margins serrate, serrulate or subentire, a few leaflets sometimes entire but others of the same leaf with at least a few serrulations. Reticulate venation prominent on both surfaces; lateral nerves not impressed above. var. *pseudorhus*
(widespread Queensland and northern N.S.W.).
- Margins always entire. Reticulate venation indistinct above; lateral nerves usually impressed above. var. *integerrima*
(Atherton Tableland).

2a. *J. pseudorhus* var. *pseudorhus*

Character as for the species and key above. Very variable in density of indumentum, leaflet size and margins and also size of inflorescences. Two forms are distinguished, the extreme forms intergrading.

1. Leaves, inflorescences and branchlets densely rusty hairy. Pinnae 14–18 in number, rarely less or more, 2.5–6 x 1–2.5 cm. Panicles usually clustered at tips of branchlets, divaricately branched, 4–26 x 4–16 cm, peduncles densely hairy forma *pseudorhus*
(Southern form.)
- Leaves, inflorescences and branchlets puberulent or glabrous. Pinnae 8–18 in number, 4–7.5 x 1–2.8 cm. Panicles in upper axils, unbranched or with few short branches, 9–18 x 2–6.5 cm, peduncles usually puberulent to glabrous forma *pilosiuscula*
(in warmer regions from New Guinea to northern Queensland, finds its southern limits at Fraser Island).

forma pseudorhus

Trees 4—9 m, usually spreading, branchlets densely hairy to puberulent; petioles, rachises, petiolules and peduncles densely rusty villous. Leaves with petiole 12—21 cm long, with (4—)7—9(—12) leaflets each side of rachis; petioles 1.5—12 cm; rachises 8.5—15(—20.5) cm; pinnae opposite or alternate, usually elliptic-ovate-oblong, falcate, tips acute-acuminate or acute, margins serrulate to subentire, bases oblique, obtuse or rounded, unequal, 2.5—6(—9) x 1—2.2(—2.8) cm, upper surfaces shiny, usually puberulent, lower ones pubescent to puberulent. Panicles 4—26 x 1.6—16 cm. Calyces densely rusty hairy outside; petals with slender, cylindrical or clavate crests. Fruits rich velvety red to orange-yellow.

From near Gladstone to Manning River, New South Wales, common form, usually in fringing forests along creek banks and in remnant rainforests.

Queensland. PORT CURTIS DISTRICT: Rodd's Bay Station via Gladstone, May 1950, *Bissett* S709; 22 km N of Rockhampton, Aug 1963, *Speck* 1706. WIDE BAY DISTRICT: 48 km SW from Bundaberg, *Bancroft* s.n. BURNETT DISTRICT: Goodnight scrub, 65 km SW of Bundaberg, Jun 1957, *Smith* 9837; Cania Gorge, May 1977, *Byrnes & Olsen* 3539. MORETON DISTRICT: Yarraman, S.F.R. 289, Feb 1972, *Moriarty* 874; North Pine River, Mar 1931, *Blake* 2358; Roberts Plateau Nat. Park, May 1929, *White* 6031. **New South Wales:** 1.6 km S of Coaldale (about 35 km NNW of Grafton), Jul 1969, *Clark, Pickard & Coveny* 1844; Duck Creek, 3 km S of Alstonville (about 13 km SW of Ballina), Nov 1965, *Constable* 6477A; Whian Whian S.F., Oct. 1966, *Jones* s.n.

forma pilosiuscula Radlk., Sitzungsber. bayer. Akad. Wiss. 9:621 (1879). **Type:** Rockingham Bay (not seen).

forma subglabrescens Domin, Biblioth. Bot. 89:906 (1927). **Type:** Emu Park, Rockhampton, *Domin* (not seen).

Trees 3—18 m; branchlets, petioles, rachises and peduncles usually with scattered villous hairs or glabrous; branchlets with small lenticels usually in the grooves. Leaves with petiole 15—27 cm long with 4—9 leaflets each side of rachis; petioles 1—8.5 cm; rachises 4.5—16 cm; pinnae opposite to alternate, usually narrowly and obliquely ovate-oblong, falcate, attenuate and acuminate at tips, margins serrulate or serrate or subentire, often serrulations pointed and glandular tipped, bases subacute, obtuse, unequal, 4—10.5 x 1.5—2.8 cm, glabrous or often midribs slightly villous. Inflorescences unbranched or with few short branches, axillary, rarely clustered at tips of branchlets, 7—18 x 2—6.5 cm; calyces puberulent or glabrous outside; petals pinkish with fleshy clavate crests. Fruits orange-yellow.

New Guinea and Queensland (from Cape York Peninsula to Fraser Island), in dry rain rainforests, beach scrubs and also in mangrove swamps.

New Guinea. WESTERN DISTRICT: Daru Island, Apr 1936, *Brass* 6437; Morehead River, about 13 km inland, Aug 1967, *Pullen* 7046; Lake Davimbu, Middle Fly River, Sep 1936, *Brass* 7943. **Queensland.** COOK DISTRICT: Somerset, Cape York, May 1962, *Webb & Tracey* 6120; Pin Pin (13°12'S, 145°28'E), Oct 1973, *Hyland* 2923; Bloomfield River, Nov 1902, *Poland* s.n.; S.F.R. 310 Goldsborough L.A. (17°11'S, 145°43'E), Mar 1979, *Gray* 1360 (QRS). NORTH KENNEDY DISTRICT: Kelsey Creek, Oct 1919, *Michael* s.n.; Behind Little Ramsey Bay, Hinchinbrook Island, Sep 1975, *Sharpe* 1707. SOUTH KENNEDY DISTRICT: R. 60 Ossa, Cape Hillsborough, May 1975, *Hyland* 4274; "The Cedars", Pioneer Shire, north of Mackay, Mar 1978, *Bishop* s.n.; R573, Eungella, Finch Hatton Gorge (21°05'S, 148°38'E), May 1975, *Hyland* 426. PORT CURTIS DISTRICT: Middle Percy Island, Mar 1906, *Tryon* s.n. WIDE BAY DISTRICT: Fraser Island, Jul 1919, *Petrie* s.n.

Very variable especially in indumentum and number of leaflets, specimens from New Guinea usually having more leaflets while those from Kelsey Creek and Eungella (near Mackay) have fewer leaflets with margins nearly entire and peduncles and branchlets hairier than others. Collections from Daru and Hinchinbrook Islands are glabrous or almost so.

The small glabrous leaved specimens from Fraser Island would probably fit under *Domin's* forma *subglabrescens*.

- 2b. *Jagera pseudorhus* var. *integerrima*** S.T. Reynolds var. nov. *J. pseudorhus* var. *pseudorhus* affinis a qua praecipue differt foliolis marginibus semper integris.
Typus: Cook District: Lake Barrine, Atherton Tableland, 9 Nov 1929, C.T. White 1354 (BRI holotypus).

Trees to 18 m, usually buttressed, trunks fluted, younger parts, petioles, rachises, petiolules and peduncles densely villous; branchlets usually stout, 6 or 7-grooved towards the tip, densely pubescent with short hairs intermingled with villous hairs. Leaves with petiole 18–26 (–35) cm long with 5–10 leaflets each side of rachis; petioles 2.5–5 (–9) cm, subterete, broad, and trisulcate at base; rachises 15–18 (–26) cm, terete, bisulcate; pinnae alternate or subopposite, obliquely ovate-oblong attenuate and acuminate or acute at tips, margins entire, bases oblique obtuse, often very unequal, 3.5–7.5 (–9.5) x 1.3–3 cm, upper surfaces glabrous except the midrib, puberulent below; midrib excentric; lateral nerves 9–11 pairs often impressed above, reticulate venation indistinct above. Inflorescences usually clustered at tips of branchlets 7.5–11.5 cm long and as wide, densely flowered, peduncles ribbed. Capsules oblongoid-ellipsoid, 1.6–2 x 1–1.8 cm.

Northern Queensland, Atherton Tableland, in rainforests at altitudes 760–1130m.

COOK DISTRICT: Forest Reserves 99, Western Logging Area (54/231), Nov 1953, *White* s.n.; S.F.R. 185, Lake L.A. (17°09'S, 145°36'E), Sep 1968, *Hyland* 1950 (QRS); S.F.R. 194 (R. 263) (17°15'S, 145°25'E), Oct 1963, *Hyland* 481 (QRS); S.F.R. 194, Western Cpt 59, E/P36, (17°19'S, 145°26'E), Mar 1977, *Unwin* 237 (QRS).

Very close to var. *pseudorhus* especially the hairy form under forma *pilosiuscula* (i.e. collections from Kelsey Creek and Eungella near Mackay) but the leaflets of var. *integerrima* are always entire on the margins and reticulate venation usually indistinct above.

- 3. *Jagera serrata* (Roxb.) Radlk.**, Sap. Holl.-Ind. 10, 36 (80, 106) (1877). Based on *Sapindus serratus* Roxb., Catal. plts. . . not yet introd. 88 (1813) & Fl. Ind. ed 2 (2) :284 (1832). **Type:** ? Moluccas (not seen).

Garuga javanica Blume, Bijdr. 1165 (1825). **Type:** not known.

Jagera speciosa Blume, Rumph. 3:155 (1847), *nom. illeg.*

Garuga javanica Blume, l.c. (1847), *pro syn.*

Trees 13–20 m, buttressed; younger parts, petioles, rachises and peduncles densely dark rusty-brown velvety hairy; branchlets stout, fluted, tomentose. Leaves whorled at tips of branchlets, 35–51 cm long including petiole, with (8–)10–13 leaflets each side of rachis; petioles 3–11 cm, semiterete, broad and trisulcate at base; rachises 25–39 cm, terete; pinnae subopposite or opposite, oblong-ovate, subelliptic-oblong, subfalcate, acute or acuminate or subobtusate at tips, margins serrate or serrulate, often serrulations gland tipped; bases acute, obtuse or rounded, oblique, unequal, 6–17.5 x 2–5 cm, upper surfaces glabrous or the midribs hairy, lower ones usually puberulent; semicoriaceous; midribs often slightly excentric, lateral nerves 9–14 pairs, reticulations lax, prominent; petiolules 1–5 mm, subterete, pulvinate. Panicles usually clustered at tips of branchlets in axil of and below velutinous young leaves and bracts, 22–38 x 14.5–19 cm, much branched and copiously flowered, peduncles ribbed, cymules usually 2 or 3-flowered; bracts ovate-oblong, velutinous, 2–8 x 1–2 mm. Flowers 4.5–5.5 mm diam., yellow; pedicels 2–4 mm, pubescent; calyx lobes broadly ovate, 1.8 x 1.5 mm, pubescent outside; petals pale pink, suborbicular, shortly clawed, 2 x 2 mm, scales half as long, broad, hairy on margins, crests fleshy, clavate; stamens 8, exerted, filaments 1–3 mm, pink, pubescent, anthers obovoid, yellow; ovaries densely setose hairy. Capsules (immature) obovoid-oblongoid, to 1.2 x 1 cm.

Moluccas, New Guinea and northern Queensland, (at Oliver Creek and around Mossman). Usually at edge of rainforests.

COOK DISTRICT: Oliver Creek (16°10'S, 145°25'E), Jun 1975, *Hyland* 3179; Intake, Mossman, Sep 1948, *Smith* 3972; Little Mossman L.A. (16°30'S, 145°25'E), Jun 1973, *Irvine* 516; about 2 km SE of "The Pinnacle" about 13 km SSE of Mossman, Aug 1977, *Moriarty* 2253 (QRS).

Very close to *J. serrata* f. *serrata* (ex descr.) but leaflets are fewer; it is possibly a form quite distinct from the two forms designated by Radlkofer.

HARPULLIA

HARPULLIA Roxb., Cat. Msc. Fl. Ind. 86 (1813) & Fl. Ind. ed 1 (2) :441 (1824).

Type species: *H. cupanioides* Roxb.

Trees or shrubs, often slender and unbranched; most species stellate hairy; branchlets terete usually with numerous small lenticels, mostly hairy when young. Leaves paripinnate, with 2–5(–8) leaflets each side of rachis; rachises and petioles often with oblique wings; pinnae opposite or alternate, entire or coarsely serrulate; sessile or shortly petiolulate. Inflorescences axillary, mostly in upper axils, supra-axillary or ramiflorous, usually thyriform panicles, polygamo-andromonoecious; bracts subulate, usually as long as pedicels. Flowers regular, mostly perfumed; pedicels usually long, articulate below middle; sepals 4 or 5, free or almost free, erect, imbricate, usually subequal, persistent or deciduous; petals 4 or 5, usually longer than sepals, linear-obovate with reflexed apex, thick; or obovate and clawed or subspathulate with 2 inflexed auricles above claw, membranous; disc small, annular, mostly lobed; stamens 5–8, usually unequal, exerted, filaments and anthers glabrous; ovaries ovoid or suborbicular, laterally compressed, 2-celled with 1 or 2 ovules in each cell; styles subulate, often long and reflexed in upper half; stigmas sometimes spiral. Capsules sessile or shortly stipitate, usually 2-lobed, variable, often with very divaricate lobes, apiculate (residual style), lobes oblongoid, ellipsoid or subglobose, inflated and bladdery or somewhat compressed, loculicidally 2-valved with 1 or 2 seeds per loculus; valves thick, ± woody or crustaceous, or thin, often veined; seeds subglobose or ellipsoid, black, shiny; aril present or absent, if present nearly enveloping seed.

37 species from Indo-Malaysia, Pacific, New Guinea and Australia; eight in Australia.

1. Petioles and rachises usually winged at least in part, rarely wingless. Capsules broadly oblongoid-obovoid somewhat compressed, truncate and apiculate at apices, lobes oblongoid, not inflated, with 2 seeds in each cell; valves thickly coriaceous and wrinkled. (Usually slender shrubs 1–4 m tall) 2
 - Petioles and rachises not winged (except in some juveniles). Capsules mostly divaricately lobed, obcordate to transversely ellipsoid or suborbicular, apiculate; lobes inflated, with 1 (rarely 2) seed in each cell, valves thick or thin, not wrinkled, often finely reticulate. (Usually trees taller than 4 m) 4
2. Petioles and rachises narrowly and obliquely winged usually to below the lowermost pair of leaflets or wingless. Leaflets thickly coriaceous and shiny; petiolulate. Inflorescences usually long and slender, drooping, 5–72 cm long, with interrupted clusters of cymules 1. *H. rhyticarpa*
 - Petioles and rachises winged to the base of petiole or to about 3–15 mm away from the base, wings often broad, entire or serrate. Leaflets thinly coriaceous, sessile or subsessile. Inflorescences not as above 3
3. Wings and margins of leaflets coarsely serrulate or dentate, rarely subentire. Leaflets semicoriaceous with raised reticulation. Wings narrowing and ending in acute or subobtusate base, 3–15 mm away from base of petiole. Flowers to 8 x 8 mm. Capsules sessile 2. *H. alata*
 - Wings and margins of leaflets always entire. Leaflets thinly coriaceous, reticulations not raised. Wings usually broad throughout ending in subcordate somewhat auriculate base, near or at base of petiole. Flowers to 17 x 7 mm. Capsules shortly stipitate 3. *H. frutescens*
4. Panicles clustered on old wood, 2–4 in a cluster, slender, 6.5–9 cm long, rarely supra-axillary. (Capsules suborbicular or broadly ellipsoid with delicately veined lobes, reddish; valves thin; arillus yellow. Leaflets 4–6 pairs, 11–27(–32) x 4–8(–11.5 cm) 4. *H. ramiflora*
 - Panicles usually in upper axils, rarely clustered below leaves, 4–47 cm long. (Capsules transversely ellipsoid to obcordate; orange-yellow with reddish tint or brownish; valves thick and crustaceous or thin, then seeds not arillate; aril red. Leaflets 2–5(–8) pairs, 5.5–19(–23) x 1.8–6.5(–9) cm 5

5. Sepals persistent in fruit; seeds nearly enclosed in aril; (valves of capsules thick, crustaceous or somewhat woody). Petals oblong, thick, not auriculate. Leaves usually coriaceous 6
 Sepals deciduous; seeds without aril; (valves of capsules thick or thin). Petals spatulate shortly clawed with inflexed auricles above claw, membranous. Leaves thinly coriaceous 7
6. Leaflets elliptic or subobovate-oblong with broad usually rounded or retuse tips, rarely apices acute; coriaceous. Inflorescences dark brown velvety tomentose, clustered in upper axils. Capsules subsessile (stipes to 1 mm long) with 2 divaricate lobes; valves subwoody, pubescent inside 5. *H. hillii*
 Leaflets elliptic-ovate, usually narrowing towards apex with acute or bluntly acuminate tips; thinly coriaceous. Inflorescences solitary, supra-axillary, peduncles finely puberulent. Capsules stipitate (stipes 2–3 mm long), lobes not divaricate, slightly compressed at sutures; valves somewhat crustaceous, or rigid, glabrous inside 6. *H. thanatophora*
7. Capsules on stipes 1–4 mm long, valves thin, delicately but not transversely veined. Flowers 6–12 x 5–12 mm; pedicels 5–10 mm; stamens 7–8; disc glabrous. Leaflets 4–6 (–13), 5.5–10.5 (–16) x 1.8–4 (–7) cm, bases narrow, obtuse, oblique. Branchlets with pale hairs 7. *H. pendula*
 Capsules on stipes 4–6 mm long, valves crustaceous, transversely veined. Flowers 1–1.6 x 1–1.4 cm; pedicels 1–5 cm; stamens 5; disc rusty hairy. Leaflets 6–9, 10–19 (–23) x 4–6.5 (–9) cm, bases obtuse, oblique, or subtruncate and usually unequal. Branchlets rusty velvety hairy 8. *H. arborea*

1. ***Harpullia rhyticarpa*** C.T. White & Francis, Qd. Dept. Agric. Bot. Bull. 22 : 10 (1920); C.T. White, Contr. Arn. Arb. 41 : 64 (1933). **Type:** Cook District: Bernard's spur, Bellenden Ker Range, *F.M. Bailey* s.n. (BRI holo).
Harpullia angustialata C.T. White & Francis l.c. : 12 (1920). **Type:** Cook District: Yarrabah, *Rev. N. Michael* s.n. (BRI holo).

Small slender trees 2–6 m, often unbranched; younger parts ferruginous pubescent; branchlets rounded, slightly striated, glabrous with few small reddish brown lenticels. Leaves with petiole (7–)18–31 (–44) cm, with 4–5 (–8) leaflets each side of rachis; rachises and often part of petiole narrowly winged or margined with entire wings which usually tapers and ends just below the lowermost pair of leaflets, or rachises wingless often zigzag; petioles 4.5–10 (–13) cm, terete, pulvinate, sometimes winged at apex, glabrous; rachises (5–)11.5–18.5 (–38) cm, terete, adaxially ridged; wings between each set of leaflets oblique, unequal, wider below insertion of leaflet and tapering to next set of leaflets; pinnae opposite or alternate, elliptic-ovate-oblong or subovate-oblong with cuneate base or elliptic-ovate, usually narrow at both ends, tips abruptly and obtusely acuminate, caudate or acute, margins entire, bases acute or narrow and subtruncate with adjacent part of lamina upturned and hiding midrib at base, 3.2–17 (–29) x 1.3–5.5 (–8.2) cm, glabrous or subglabrous, dark glossy green and shiny, discolorous, thickly coriaceous with prominent nerves, lateral nerves 10–18 pairs, arcuate, usually ascending at tips; reticulation prominent especially below; petiolules 2–4 mm, thick, pulvinate. Inflorescences in upper axils, usually 1–5 per axil, 5–72 x 1–3 cm, usually long and slender and pendulous with golden brown tomentose peduncles bearing interrupted clusters of 3–17 flowered cymes; bracts subulate. Flowers whitish, fragrant, 13–15 x 8–13 mm; pedicels to 7 mm, tomentose; sepals oblong-ovate, obtuse, 8–10 x 6 mm, yellow with pale margins, tomentose; petals white, obovate-cuneate, with reflexed tip, 12–14 x 3–5 mm, glabrous; disc sinuate lobed, pubescent; stamens 5 or 6, filaments slender, to 6 mm long, anthers apiculate, 3.5 mm long; ovaries villous. Capsules shortly stipitate, orange-yellow with rosy-pink flush or pinkish flush; broadly obovoid-oblongoid, apiculate, 1.4–2.5 x 2.5–4 cm, (grooved in the middle with lobes oblongoid) broader at apex, slightly compressed; valves coriaceous, drying wrinkled, pubescent outside and puberulent and deep pink inside; seeds usually 2 in each cell, shiny, blackish with cupular yellow aril nearly enclosing it; sepals persistent; stipes 2–3 mm long.

Northern Queensland, especially common around Atherton Tableland; in rain-forests in hilly and mountainous country and lowland ridges, usually on granite.

COOK DISTRICT: Upper Parrot Creek, Annan River, Sep 1948, *Brass* 20172; Bloomfield near Hopevale, Sep 1960, *Smith* 11103; near Noah Creek (16°10'S, 145°10'E), Apr 1972, *Hyland* 5977; Cape Tribulation, Jul 1976, *Jackes* s.n.; Mt Spurgeon, Sep 1936, *White* 10547; Mt Misery on Mt Carbine Tableland, Sep 1972, *Webb & Tracey* 10824; Mossman, Aug 1948, *Smith* 3941; Mt Lewis, Nov 1976, *Moriarty* 2169; Saddle Mt, near Kuranda, Apr 1967, *Winkel* s.n.; Davies Creek, Mareeba District, May 1962, *McKee* 9462; Yungaburra near Lake Barrine, June 1932, *Blake* 9595; NORTH KENNEDY DISTRICT: Kirrama Range, Aug 1955, *Volck* 1103.

A very variable species in leaves and length of inflorescence but easily distinguished by its very coriaceous and shiny discoloured leaves with prominent nerves; rachises if winged never extending far from basal pair of leaflets and very long slender pendulous inflorescences.

2. *Harpullia alata* F. Muell., *Fragm.* 2 : 103 (1860); Benth., *Fl. Aust.* 1 : 470 (1863); F.M. Bailey, *Qd. Fl.* 1 : 308 (1899); R.H. Anders., *The trees of N.S.W.*, 257 (1957); Francis, *Aust. Rain-For. trees*, ed 3 : 261 (1970). **Type:** Clarence River, N.S.W., *Dr. Beckler* (Not seen).

Misapplied name: *Harpullia frutescens* C.T. White, *Qd. Nat. 1, Bot. Notes* 1 : 204 (1911), from McPherson Range.

Tall straggly slender shrubs or small trees 1-7 m, usually few branched; young parts ferruginous tomentose; branchlets glabrous, with small raised lenticels. Leaves clustered at tips of branchlets, 12-33(-42) cm long including petiole, with 3-6 leaflets each side of rachis; rachises and petioles broadly winged with oblique, reticulate, denticulate mucronate, repand or rarely subentire wings; petioles 6-10.5 cm, terete, pulvinate, the wings usually tapering and ending in acute or subacute base 3-15 mm away from base of petiole (juvenile leaves sometimes winged to the base of petiole), solitary gland often present near base of petiole, glabrous; rachises (8.5-) 11-18(-23) cm, terete, wings between each set of leaflets usually wider at apex, narrowing to base, glabrous; pinnae sessile or subsessile, opposite or subopposite, elliptic or elliptic-obovate abruptly acuminate at tips; margins like the wings on rachis and petiole usually irregularly and coarsely serrulate or repand dentate, rarely subentire; bases cuneate, obtuse or subacute and decurrent, oblique, or subtruncate, 6-18 x 2.5-7 cm, lowermost pair the smallest, glabrous, rarely puberulent, shiny, dark green, semicoriaceous, lateral nerves 8-16 pairs, subpatent, reticulate venation forming dense network, areoles minute, prominent, raised below; petiolules if present 1-3 mm, thick, glabrous. Inflorescences axillary, slender, few flowered racemes, 5-14 cm long, (females shorter than males), peduncles puberulent, lenticellate. Flowers white, 8 x 8 mm; pedicels to 1.3 cm long; sepals ovate, obtuse, 7 x 5 mm, puberulent outside, pubescent inside; petals linear or subobovate-oblong to 12 x 3 mm, glabrous; discs rusty hairy; stamens 8, filaments slender, glabrous; ovaries 2-lobed, pubescent, style flat, sometimes reflexed. Capsules sessile, yellowish, broadly obovoid, 1.8-2.4 x 2.8-3.8 cm, lobes obliquely oblongoid, often wider at apex, turgid, slightly compressed at margins; valves coriaceous, wrinkled, minutely hairy outside, glabrescent to puberulent inside; seeds 2 in each cell, shiny, chestnut-brown, nearly enveloped by yellow to reddish aril; sepals persistent.

Southern Queensland and northern New South Wales, from McPherson Range, where it is quite common, to Clarence River, usually at high altitudes in gullies and steep slopes.

Queensland. MORETON DISTRICT: Upper Nerang River, May 1977, *Byrnes* 3512; Ships Stern track, Lamington National Park, Apr 1976, *McDonald & Clarkson* s.n.; Beechmont, Sep 1929, *White* 6198. **New South Wales.** Geebung L.A., Whian Whian S.F. near Lismore (28°35'S, 153°20'E), Aug 1975, *Moriarty* 1688.

Very close to *H. frutescens* which differs in having entire leaflets and wings of rachis extending to base of petiole and ending in subcordate base. Flowers also larger.

3. *Harpullia frutescens* F.M. Bailey, Rept. Bellenden Ker Expd. 15 (1889), Qd. Fl. 1: 308 (1899). **Type:** Cook District: Bellenden Ker, (alt. over 2,000 ft) *F.M. Bailey* s.n. (BRI holo).

Misapplied name: *H. alata* F. Muell., Fragm. 9: 89 (1875) — from Rockingham Bay.

H. marginata Radlk., Engl. & Prantl, Nat. Pflanzenfam. 3 (5): 362 (1895). **Type:** not seen, probably from Cairns.

H. holoptera Radlk., Fedde Report. 20: 40 (1924). **Type:** Cook District: Mulgrave, 1907, *Diels* 830 a & b (not seen).

Tall shrubs or small trees to 1 m, slender, unbranched; branchlets rounded, somewhat warty, lenticellate, pubescent or puberulent. Leaves with petiole 18–38 cm, with 3–4(–5) leaflets each side of rachis; rachises and petioles broadly winged to the base of petiole; petioles 3.5–8.5(–10) cm, the broad wing ending at broad pulvinus in a subcordate or auriculate base, glabrous or puberulent; rachises 4.5–18.5 cm, terete, glabrous above, puberulent below; wings broad, entire, reticulate, often slightly wider at apex between each pair of leaflets and oblique; pinnae sessile, rarely subsessile, subopposite or alternate, elliptic or elliptic-oblong, often slightly wider above middle, usually narrow at both ends, tips abruptly acuminate or caudate, margins entire, repand, bases narrowly subcordate or truncate, 7.5–17(–19) x 2.3–5(–7) cm, dark green, shiny, glabrous or midribs puberulent above, puberulent or glabrous below, the midribs usually pubescent or puberulent, thinly coriaceous; lateral nerves 9–11 pairs, fine, \pm arcuate, reticulate venation fine; petiolules to 1 mm, pulvinate. Inflorescences mostly in upper axils, often 2–4 in a cluster, 3–12 cm long and about half as wide, few branched, laxly flowered; peduncles slender, densely pale rusty hairy or puberulent. Flowers 1.7–2 x 0.7 cm, white with pink tinge, fragrant; pedicels to 5 mm, puberulent with scattered large rusty stellate hairs; sepals 4 or 5, obovate-oblong, 7–8 x 3 mm, reddish-brown, paler at margins, pubescent; petals 4, obovate-oblong, cream, 15–20 x 3.5 mm, reflexed at apex, glabrous; disc 5(or 6)–lobed, finely puberulent; ovaries 2–lobed, tomentose, style thick, recurved. Capsules shortly stipitate, crimson, broadly oblongoid-obovoid, broader than long, 1.2–1.6 x 1.8–2.2 cm, lobes irregularly oblongoid, slightly compressed; valves coriaceous, wrinkled when dry, puberulent or pubescent outside, glabrous inside; seeds 2 per cell, enclosed in cupular yellow aril; sepals persistent; stipes 1–2 mm long.

Northern Queensland, from Ayton to Atherton Tableland area where it is quite common in rainforests, usually in hilly country.

Queensland. COOK DISTRICT: Ayton, Jul 1962, *Gittins* P 576; Mt. Bartle Frere, Jan 1935, *Flecker* s.n.; S.F.R. 185, Downfall L.A. (17°10'S, 145°36'E), *Unwin* 9 (QRS); Juara Creek, Danbulla, Aug 1948, *Smith* 3740. NORTH KENNEDY DISTRICT: Herberton, *Bancroft* s.n.; Evelyn, in 1899, *Bailey* s.n.

4. *Harpullia ramiflora* Radlk., Sapin. Holl.-Ind. 54 (126) (1877); Engl. & Prantl, Nat. Pflanzenfam. 3(5):362 (1895). **Type:** New Guinea (not seen).

Slender small trees 3–9 m, sparsely branched; branchlets glabrous, pale, with numerous small brown lenticels. Leaves with petiole 30–45(–70) cm, with 4–6 leaflets each side of rachis; petioles 3.5–9.5(–19) cm, terete, pulvinate, glabrous; rachises 23–27(–44) cm, terete, wingless, glabrous; pinnae alternate, oblong-ovate-elliptic or elliptic-oblong, acute or acute-acuminate at apices, margins entire, bases acute or obtuse, 11–27(–32) x 4–8(–11.5) cm, dark green, glabrous, semi-coriaceous, lateral nerves 12–18 pairs, arcuate, ascending at tips, usually slightly impressed above; petiolules terete, grooved above, 3–8 mm. Inflorescences usually ramiflorous and clustered with 2–4 per cluster, or supra-axillary, 6.5–20 x 1–11 cm, few branched and laxly flowered, peduncles ribbed, slender, minutely rusty pubescent or puberulent. Flowers white, 1–1.3 x 0.6–1 cm, fragrant; pedicels 5–8 mm, articulate below middle, pubescent; sepals 5, oblong-elliptic or obovate, slightly con-

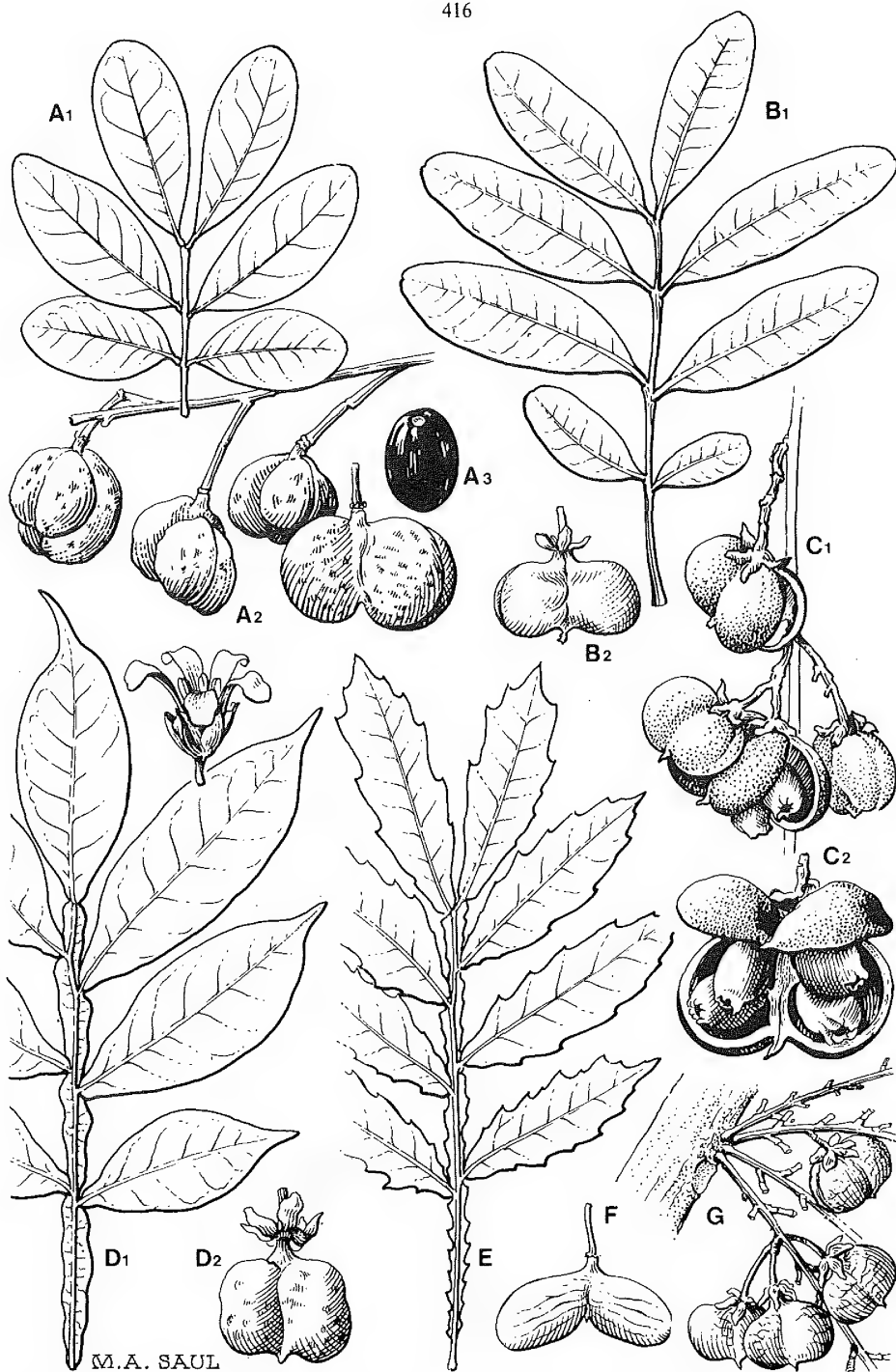


Figure 29. *Harpullia*. A. *H. pendula*. A1. Leaf (x 1/3). A2. Fruit (x 1). A3. Seed (x 1). B. *H. hillii*. B1. Leaf (x 1/3). B2. Fruit (x 2/3). C. *H. rhyticarpa*. C1. Fruits. C2. Fruit (x 1). D. *H. frutescens*. D1. Leaf (x 1/3). D2. Fruit (x 1). E. *H. alata*, leaf (x 1/3). F. *H. arborea*, fruit (x 2/3). G. *H. ramiflora*, fruits (x 2/3).

cave, 6–7.5 x 3–4 mm, pubescent; petals 4, twice as long as calyx, narrowly obovate oblong, reflexed at apex, 9.5–13 x 3–4 mm, glabrous, thick, veined; disc sinuate-lobed, pubescent; stamens 5, usually unequal, filaments \pm subulate, 2.5–6.5 mm, glabrous (in females to 2.5 mm long), anthers ovoid-oblong, 3 x 1.2 mm; ovaries tomentose. Capsules shortly stipitate, reddish, suborbicular to transversely broad ellipsoid with 2 suborbicular to \pm ellipsoid inflated lobes, 1.2–1.8 x 1.8–2.2 cm, slightly compressed at junction of valves; valves thin, delicately veined, puberulent outside, glabrous inside; seeds solitary in each cell, black, enclosed in yellow aril; sepals persistent; stipe to 2 mm long.

New Guinea to northern Queensland, common in riverine rainforests or at edge of rainforests; probably widespread in New Guinea. Only so far recorded from Iron Range in Queensland, this being a new record of the species for Australia.

New Guinea. From Fly River to Milne Bay District, between 8°–10°S lat. and 143°–150°E long. Northern District: Wanigela (10°05'S, 148°10'E), Aug 1965, *Buderua* s.n. (NGF 20776); Palmer River, 3 km below junction Black River, Jul 1963, *Brass* 7246. **Queensland.** COOK DISTRICT: Rocky River Catchment, Sep 1973, *Hyland* 2851; Claudie River, Iron Range, Jul 1978, *De Baar* s.n.

5. *Harpullia hillii* F. Muell., Trans. Philos. Inst. Vict. 3:26 (1859), & Fragm. 2:104 (1860); Benth., Fl. Aust. 1:470 (1863); F.M. Bailey, Qd Fl. 1:308 (1899); R.H. Anders., Trees of N.S.W., 257 (1957); Francis, Aust. Rain-For. trees, ed 3:261 (1970). **Type:** Durando, *W. Hill* (not seen).

Trees 6–20 m; young parts puberulent; branchlets striated, often pale with numerous small elliptic lenticels and scattered rusty red stellate hairs; peduncles and flowers with dark brown rusty velvety stellate tomentum. Leaves with petiole 13–35(–70) cm, with (1–)3–5(–8) leaflets each side of rachis; petioles 3.5–8(–10.5) cm, terete, pulvinate, glabrous, often lenticellate; rachises (3.5–) 5.5–12(–19) cm, terete, wingless (some juvenile leaves often obliquely winged), glabrous, often lenticellate; pinnae alternate or subopposite, elliptic-oblong or subobovate, apices rounded, obtuse, retuse, margins entire, bases subacute or obtuse, often oblique and subequal, 5.5–16(–23) x 2.5–5.3(–7.2) cm, lowermost pair the smallest, glabrous, coriaceous, discolorous, shiny above; lateral nerves 9–18 pairs, arcuate and looping at margins; petiolules 3–6 mm, semiterete. Thyrsiform panicles in upper axils, copiously flowered, 14–30 x 5–22 cm; bracts subulate, to 6 mm long. Flowers 0.8–1 x 1.2 cm; pedicels to 4 mm; sepals obovate-elliptic, 6–8 x 4–6 mm, velvety outside with yellowish hairs, tomentose inside; petals oblong, obtuse at reflexed apex, 8–12 x 4 mm, white, glabrous; disc minute, pubescent; stamens 5, usually unequal, filaments 4–5 mm long, anthers minutely apiculate, 3 mm long. Capsules shortly stipitate, yellowish, transversely ellipsoid to depressed obovoid; attenuate at base, or subobcordate, with divaricate, inflated, subglobose to ellipsoid lobes, 1.3–1.5 x 2.7–3.5 cm, valves subwoody, veined, pubescent or puberulent outside, densely long hairy inside; seeds mostly solitary, black, enclosed in red aril; sepals persistent.

Chiefly coastal from Burdekin River, Queensland, to Clarence River, New South Wales, usually in dry rainforests on hillsides.

Queensland. NORTH KENNEDY DISTRICT: Clare-Burdekin Levee, Jun 1949, *Smith* 4408 & 4409; Cannonvale area, 1976, *Wynne* s.n., SOUTH KENNEDY DISTRICT: Mackay, Nov 1889, *Griffith* s.n. PORT CURTIS DISTRICT: Rockhampton, *Bzerley* s.n.; S of Round Hill Head on inland side of Peninsula, Mar 1970, *Everist* s.n. WIDE BAY DISTRICT: Bingera, Oct 1948, *Smith* 4121; Dundowran, Sep 1965, *Gittins* 1134. BURNETT DISTRICT: Mt Perry, *Keys* s.n. MORETON DISTRICT: Yarraman, May 1925, *Cameron* s.n.; D'Agiular Range NW of Brisbane, Aug 1972, *Moriarty* 965; South Pine, *Hill* s.n.; Green Island, Moreton Bay, Nov 1914, *White* s.n.; Hotham Creek, on way to Beechmont, Dec 1952, *Smith* 5140; 3 km S of Canungra, Nov 1970, *Williams* s.n. **New South Wales.** Recorded from Whian Whian S.F. to Kangaroo River S.F.

Tips of leaflets vary, the southern ones usually with rounded retuse tips while some northern ones have abruptly acuminate or acute apices.

6. *Harpullia thanatophora* Blume, Rumph. 3: (1847). **Type:** New Guinea (not seen).

H. leichhardtii F. Muell. ex Benth., Fl. Aust. 1:470 (1863); Radlk., Sap. Holl.-Ind. 52 (122) (1877). **Type:** Port Essington, *Leichhardt* (not seen).

Trees; young parts and peduncles puberulent, branchlets with small lenticels. Leaves with petiole 12–30 cm, with 2–3 leaflets each side of rachis; petioles 3–7 cm, terete, pulvinate; rachises 9.5–11.5 cm, terete, wingless; pinnae alternate, variable, elliptic-ovate to elliptic-oblong, oblique, usually attenuate at tips, acute or obtusely acuminate or obtuse, margins entire, bases rounded or obtuse, subequal, oblique, glabrous or lower surfaces glabrescent, shiny above, thinly coriaceous; lateral nerves 7–12 pairs, suboblique, slender, reticulations lax, fine; petiolules 3–10 mm, grooved above. Inflorescences solitary, supra-axillary, 6–14 cm long, laxly branched. Flowers not seen; persistent sepals elliptic, to 5 x 2.5 mm, tomentose. Capsules stipitate, broadly subobcordate or to broadly transversely ellipsoid, with \pm suborbicular, inflated lobes, slightly compressed at margins, 1.4–2.2 x 2.5–4.2 cm, valves thick, somewhat crustaceous, puberulent outside, glabrous inside; seeds solitary, ellipsoid, covered by aril; stipe 2–3 mm long.

New Guinea and northern Australia, in rainforests.

Northern Territory. Yirrkala Mission, Jan 1974, *Scarlet* s.n.

7. *Harpullia pendula* Planchon ex F. Muell., Trans. Philos. Inst. Vict. 3:26 (1859), Fragm. 2:104 (1950); Benth., Fl. Aust. 1:471 (1863); F.M. Bailey, Qd Fl. 1:309 (1899); R.H. Anders., Trees of N.S.W., 256 (1957); Francis, Aust. Rain-For. trees, ed 3:261 (1970). **Type:** Forests near Moreton Bay (not seen).

Trees 10–15 m high and to 50 cm girth; buttressed; younger parts and peduncles with scattered pale brown, fine appressed stellate hairs; branchlets pale with small ellipsoid lenticels. Leaves with petioles 11.5–28 cm long with 2 or 3 (–7) leaflets each side of rachis; petioles 2.2–5.5 (–10) cm, subterete, pulvinate; rachises 1.5–6 (–9) cm, terete, adaxially ridged, wingless; pinnae alternate, elliptic-oblong or subobovate-oblong, apices acuminate or obtuse, margins entire, bases subacute or obtuse, oblique, 5.5–10.5 (–16) x 1.8–4 (–7) cm, pale green, glabrous or puberulent especially on midribs below, semicoriaceous; lateral nerves 6–12 pairs, reticulate venation lax; petiolules 3–6 mm, slender, adaxially ridged, glabrescent or glabrous. Thyrsiform panicles supra-axillary, narrow, laxly branched and flowered, 3–28 cm long, cymes 2 or 3 flowered. Flowers 6–12 x 5–12 mm, greenish-yellow, faintly perfumed; pedicels 5–10 mm, pubescent; sepals oblong or suborbicular, concave, 4–5 x 3–3.5 mm, pubescent or puberulent, deciduous; petals obovate with auriculate short claw, 7–8 x 3 mm, pubescent inside (towards base), puberulent outside; disc crenulate, glabrous; stamens 7 or 8, filaments 6 mm long, subulate; ovaries tomentose, style stout to 1 cm long, twisted or sigmoid at apex. Capsules very shortly stipitate to nearly sessile, reddish ripening yellow-orange with red flush, transversely ellipsoid with very divaricate, subglobose, bladder lobes, 1.3–2.4 x 2.6–3.8 cm, valves thin, delicately veined, subglabrous outside, glabrous inside; seeds mostly solitary, subglobose, shiny, black, exarillate; stipes, 1–3 mm long, puberulent.

Coastal from Black Mt near Helenvale, northern Queensland to Bellinger River, New South Wales; usually along creek banks in dry or cleared rainforests on basalt.

Queensland. COOK DISTRICT: Black Mountain (15°31'S, 145°14'E), Aug 1959, *Smith* 10717A; Roadside Mulgrave River approx N of crossing, May 1971, *O'Farrell* s.n.. NORTH KENNEDY DISTRICT: Koolmoon Creek 16 km SSE of Ravenshoe, Sep 1950, *Smith* 4725; Stuart Creek, S of Townsville, Aug 1942, *Smith* 4102. SOUTH KENNEDY DISTRICT: Mackay, Nov 1897, *Nugent* s.n. PORT CURTIS DISTRICT: 10 km SW of Tynan Homestead, June 1963, *Lazarides* 6890; Baffle Creek District, Apr 1920, *White* s.n. WIDE BAY DISTRICT: Dundowran via Nikenbah, Jul 1928, *Tryon* s.n.; Imbil, Nov 1917, *Epps* s.n. BURNETT DISTRICT: Mt. Perry, *Keys* s.n. MORETON DISTRICT: Brookfield, Brisbane, Jul 1971, *Moriarty* 749; 3 km S of Canungra, Nov 1970, *Williams* s.n.; Burleigh Heads, May 1977, *Byrnes* 3519. **New South Wales.** Recorded from Tweed Heads to Bellinger River: 19 km from Woodenbong on Stanthorpe Rd, Nov 1946, *Everist & Webb* 1394; Tweed Heads, Jan 1914, *Boorman* s.n.

Common Name: "Tulipwood" or "Tulip Lancewood".

Uses: Timber used for cabinet making, penholders, walking sticks. Also cultivated as an ornamental tree.

8. *Harpullia arborea* (Blanco) Radlk., Sitzungsber. bayer. Akad. 16:404 (1886); Engl. & Prantl, Nat. Pflanzenfam. 3(5):362 (1895). Based on *Ptelea arborea* Blanco, Fl. Filip. 63 (1837). **Type:** not seen.

Blancoa arborea Blume, Rumph. 3:181 (1847). Based on *Ptelea arborea* Blanco.

Otonychium imbricatum Blume l.c. 180 (1847). **Type** : not seen (? from Ceylon).

H. imbricata Thw., Enum. Pl. Zey. 56 (1859). Based on *Otonychium imbricatum* Blume.

H. blancoi F.—Villar, Blanco, Fl. Filip. ed 3:4 (1880). Based on *Ptelea arborea* Blanco.

Trees 10–20 m tall and 6–20 cm girth; young parts dark rusty velvety tomentose; branchlets pale with numerous small lenticels, pubescent to glabrescent. Leaves with petiole 15–37 (–53) cm with 3–5 leaflets each side of rachis; petioles 4–9 (–12.5) cm, broad at base, glabrescent or pubescent especially towards the base; rachises 4–22 (–34) cm, terete, pubescent or glabrescent; pinnae alternate or subopposite, elliptic-oblong or elliptic-subobovate, apices acute, acuminate, often abruptly acuminate or obtuse, margins entire; bases oblique, obtuse and usually unequal, 10–19 (–27) x 4–6.5 (–10) cm, glabrous or puberulent on the midrib and nerves below, semicoriaceous; petiolules 4–6 mm, dark rusty tomentose. Inflorescences in upper axils or ramiflorous and clustered on short lateral branches, usually 2 or 3 in a cluster, laxly branched and flowered, males 4–22 cm long, females 15–47 cm long, peduncles rusty pubescent or puberulent with large stellate hairs, cymules 2 or 3 flowered. Flowers 1–1.6 x 1–1.4 cm, greenish white or yellowish, females larger and on longer stalks; pedicels 1–5 cm long, filiform, usually drooping, pubescent with large stellate hairs; sepals obovate-elliptic, 6–7 x 3.5–4 mm, outer pair smaller, membranous, pale, deciduous, pubescent, hairs shorter inside; petals spatulate, clawed with inflexed auricles above claw, 12–14 x 4.5 mm, glabrous except finely puberulent claw; disc rusty hairy; stamens 5, filaments filiform, 1.3 cm long, conduplicate in bud, anthers 3 mm long; ovaries stipitate, elliptic, densely rusty hairy, style 1 cm long, twisted at apex, pubescent towards base. Capsules stipitate, orange-red or orange-yellow with pink flush, broadly obcordate, deeply 2-lobed especially at apex, 1.5–2.3 x 2.8–5 cm, lobes subglobose, inflated, compressed and carinate at sutures; valves thick crustaceous, transversely nerved, puberulent outside, glabrous inside; seed usually solitary in each cell, shiny, black, exarillate; stipes 4–6 mm long, rusty tomentose.

India, Malaysia, Solomon Islands, Phillipines, Indonesia, New Guinea and northern Queensland. In rainforests usually in hilly country.

New Guinea. NEW BRITAIN: E of Airagilpua, Talasea, Nov 1965, *Frodins* s.n. (NGF 26274.). GULF DISTRICT: SW margin of junction of Kapua & Tauri rivers, Mar 1966, *Schodde & Craven* 4641. MOROBE DISTRICT: Bulolo, Sep 1962, *Havels* s.n. (NGF 15424.). **Queensland.** COOK DISTRICT: V.C.L. Noah on Cape Tribulation Rd., near Noah head (16°10'S 145°10'E), Apr 1972, *Hyland* 5968.

Only once collected from Queensland, the specimen being in fruit. This is a new record of the species for Australia.

Imperfectly known species

1. *Harpullia holoptera* Radlk., Fedde Repert. 20:40 (1924). **Type:** Mulgrave River, Diels (not seen). It is probably the same as *H. frutescens* and retained as such under *H. frutescens* until type material becomes available.

2. *Harpullia divaricata* Radlk., Sitzungsber. bayer. Akad. 20:279 (1890) **Type:** ? Bloomfield River, *E. Bauer* (not seen). No specimens in herbarium under this name, probably the same as *H. arborea* (Blanco) Radlk. as far as description goes.

A REVISION OF *ATYLOSIA* (LEGUMINOSAE) IN AUSTRALIA

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Queensland Herbarium, Brisbane

Summary

Ten species (9 endemic) of *Atylosia* occur in Australia. Virtually all species are confined to the tropics. They are described and a key to their identification is given. *A. latisejala* is a new species based on *A. grandifolia* Benth. var. *calycina* Benth. *A. acutifolia* and *A. pubescens* are new combinations based on *Rhynchosia acutifolia* F. Muell. ex Benth. and *Tephrosia pubescens* Ewart & Morrison respectively. *A. mareebensis*, *A. reticulata* subsp. *maritima*, *A. scarabaeoides* var. *pedunculata* and *A. pubescens* var. *mollis* are described as new. *A. grandifolia* Benth. is conspecific with *A. reticulata* (Dryander) Benth. and *Rhynchosia quadricullosa* Domin with *A. acutifolia*. Lectotypes have been chosen for *A. acutifolia* and *A. cinerea*.

Ten species of *Atylosia* occur in Australia, nine of them endemic. They are virtually confined to the tropics with their greatest development in north-eastern Queensland and the Kimberley region of Western Australia. Further studies are needed to define more exactly the geographic ranges and range of variation of some species, particularly *A. reticulata*, *A. latisejala* and *A. pubescens*.

Generic limits within the Cajanineae are not well defined (Pedley 1981) but if *Rhynchosia acutifolia* is transferred to *Atylosia* then the Australian species of *Atylosia* become a reasonably coherent group. Morphologically and genetically (Kumar *et al.* 1958) *Atylosia* and *Cajanus* are closely related and may not be distinct. *C. cajan* however is known only in cultivation and exhibits an extremely wide range of variation and is probably best maintained in a genus apart from *Atylosia*. The position of *C. kerstingii* Harms, a native of West Africa, which has a well defined rim aril (Lackey 1977) will have to be reconsidered.

1. Stems trailing, slender 2
Stems usually erect, or decumbent, stout 4
2. Leaflets up to 3.5 x 1.7 cm. Pods not mottled with purple, valves coriaceous with prominent transverse grooves between the seeds. 1. *A. scarabaeoides*
Leaflets up to 10.5 x 6 cm. Pods usually mottled with purple, valves thin; grooves between seeds not prominent 3
3. Leaflets broadly obovate, obcordate or suborbicular 2. *A. marmorata*
Leaflets narrowly ovate, acute 3. *A. mareebensis*
4. Leaflets digitately trifoliate 5
Leaflets pinnately trifoliate 6
5. Leaflets elliptic or elliptic obovate, up to 2.5 cm wide, lateral ones never suppressed.
Pods villous tomentose 4. *A. pluriflora*
Leaflets narrowly ovate—oblong, up to 0.8 cm wide, lateral ones suppressed on flowering shoots; pods pubescent, short hairs intermixed with long pale ones 5. *A. lanceolata*
6. Calyx lobes broadly ovate—lanceolate with a distinct midrib, pink, conspicuous in fruit 8. *A. latisejala*
Calyx lobes linear to narrowly ovate, occasionally with a rib, but neither pink nor conspicuous in fruit 7
7. Leaflets not rugose, venation fine. Pod 2 or 3—seeded 6. *A. acutifolia*
Leaflets at least slightly rugose, venation usually coarse and conspicuous on lower surface. Pod 2—6—seeded 8
8. Pod with short velvety indumentum; calyx ribbed, with \pm appressed hairs 7. *A. cinerea*
Pod with long hairs, with or without short velvety indumentum; calyx not ribbed, with spreading hairs 9
9. Leaflets without silvery sheen 9. *A. reticulata*
Leaflets usually with silvery sheen 10. *A. pubescens*

1. *Atylosia scarabaeoides* (L.) Benth., in Miq., Pl. Jungh. 242 (1852). Based on *Dolichos scarabaeoides* L., Sp. Pl. 726 (1753). **Types:** Ceylon, *Hermann* 1:34 & 2:60 (BM, syn., not seen); *Burman* 900.9 (LINN, syn. microfiche).

Trailing perennial, branchlets slender, softly tomentose. Leaves pinnately trifoliate; petioles 1–1.2 cm long; rachises 2–6 mm; leaflets narrowly elliptic, lateral ones obliquely elliptic, 1.8–3.5 x 0.5–1.2 cm, tips obtuse or acute, bases obtuse, surfaces pubescent, rugose, lateral nerves 3–5 pairs, oblique, basal pair very long, obliquely arched and ascending along the margins; terminal petiolules 0.3–1 cm long, lateral ones about 2 mm. Flowers 1—paired or in a few flowered racemes, axillary. Racemes 0.5–15 cm long; flowers 7–10 mm long; pedicels 5 mm long; calyx lobes narrowly ovate-acuminate. Pods 1.7–2 x 0.6–0.8 cm, oblong, apex truncate with a minute apical point or distinct, short tip, finely velvety tomentose with long and short brown hairs; valves coriaceous with prominent transverse grooves between the seeds; seeds 2–5.

Usually in open woodlands. Flowers and fruits April to August.

1a. *A. scarabaeoides* var. *scarabaeoides*

A. scarabaeoides var. *queenslandica* Domin, Biblioth. Bot. 89:227 (1926). **Type:** in xerodrymio apud opp. Pentland, Feb 1910, *Domin* “4870” (PR, holo).

Flowers 1—paired or in few flowered racemes to 2.5 cm long. Pods 2 x 0.6 cm softly tomentose with long and short brown hairs, apex with distinct short tip; seeds 3–5, oblongoid, dark brown, aril not as broad as the seed.

Usually in open and cleared woodlands on heavy soil. Flowers and fruits April to August.

Queensland: COOK DISTRICT: “Lakeland Downs”, ca 15°50'S 144°40'E, May 1975, *Byrnes* 3463 (BRI). NORTH KENNEDY DISTRICT: Kirklea Pastoral Holding near Ingham, May 1959, *Gude* (BRI); Burdekin River area, 20°19'S 147°17'E, *Staples* IBS 2115 (BRI).

1b. *A. scarabaeoides* var. *pedunculata* Reynolds & Pedley, varietas nova;

var. *scarabaeoides* habitu minus ramoso, foliis vulgo minus rugosis membranaceisque, racemis semper in pedunculis 6–15 cm, longis portatis, leguminibus brevioribus, 1.7 x 0.8 cm longis, subtiliter velutine tomentosis sine pilis longis obsitis truncatis acuminibus minutis apicalibus, seminis 2–3, late obovoideis, rufescentibus, arillo crassissimo seminis latitudinem aequanti praeditis differt. **Typus:** *McKee* 9363 (BRI, holotypus).

Differs from *A. scarabaeoides* var. *scarabaeoides* in having a more open habit, leaves usually less rugose and more membranous, racemes always on long peduncles 6–15 cm long. Pods shorter, 1.7 x 0.8 cm, truncate with minute apical points, usually finely velvety tomentose without long hairs; seeds 2 or 3, broadly ovoid, reddish brown with very thick aril as broad as the seeds.

North-eastern Queensland to Western Australia usually on sandy lateritic soils in open forest. Flowers and fruits April to May.

Western Australia. Camballin, May 1970, *Power* 884 (PERTH); near Gariyeli Creek, Prince Regent River, 15°32'S 125°13'E, Aug 1974, *George* 12608 (PERTH). **Northern Territory.** Gunn Pt., 12°10'S 131°05'E., May 1973, *Dunlop* 3051 (DNA, BRI, NT); Lloyd Creek, 12.7 miles NW of Pine Creek, Mar 1961, *Chippendale* NT 7625 (BRI). **Queensland.** COOK DISTRICT: Parada, Apr 1962, *McKee* 9363 (BRI).

Atylosia scarabaeoides is widespread in the tropics of the Old World. The var. *pedunculata* is a distinctive variant that may be worthy of higher rank, but until the species is studied throughout its range it is preferable to consider it as a variety only.

2. *Atylosia marmorata* Benth., Fl. Aust. 2:263 (1864). **Types:** Upper Victoria River, *Mueller*; Islands of Gulf of Carpentaria, *Brown*, *Henne*; Nebo Creek & Bowen River, *Bowman*; Port Denison, *Fitzalan* (none seen).

Annual or perennial with trailing stems, branchlets hirsute or tomentose. Leaves pinnately trifoliolate; stipules cordate to 4 mm long; petioles 1.5–6.5 cm; rachises 0.6–1.4 cm; leaflets broadly obovate, obcordate or suborbicular, broader than long, 2.5–8 x 2.5–6 cm, tips obtuse, blunt or retuse, bases obtuse, surfaces pubescent or puberulent; terminal petiolules 0.6–1.5 cm, lateral ones 1–2 mm long; stipellae linear to 2 mm; Inflorescence racemose, 1–4 per axil, 4–7 (–50) cm long, peduncles slender, sometimes branched, bearing 1 or 2 flowers at long intervals. Flowers about 1.2 cm long; pedicels 3–7 mm long. Calyces 0.5–1.2 x 0.6 mm, lobes ovate acuminate, 4–6 mm long, pubescent. Petals 1.2 cm long. Pods oblong 1.5–4 x 0.8–1.4 cm, valves usually mottled with purple, puberulent, thin with fine transverse reticulations, grooves between the seeds faint; apiculate tips 2–8 mm long; seeds 2–5, broadly obovoid or oblongoid, reddish brown, aril thick and fleshy.

Widely spread in northern Australia, usually in cleared areas and open forests on sandy soil. Flowers and fruits February to November.

Western Australia. Geikie Gorge, Fitzroy River, Aug 1965, *Beaglehole* ACB 11187 (PERTH); near junction of Hann and Fitzroy R., Jun 1905, *Fitzgerald* (PERTH); Razorback, near Carlton Beach, Ord. R., Apr 1958, *Burbidge* 5748 (PERTH). **Northern Territory.** 15 miles S of Inningurra Ra., Aug 1971, *Maconochie* 943 (NT, PERTH); 16 miles SE of Pine Creek, Mar 1961, *Chippendale* NT 7573 (BRI, PERTH); Groote Eylandt, Apr 1948, *Specht* 258 (BRI); Settlement Creek, Feb 1923, *Brass* 266 (BRI). **Queensland.** BURKE DISTRICT: Adels Grove, Apr 1950, *de Lestang* 460 (BRI). COOK DISTRICT: Newcastle Range, Apr 1906, *Blackman* (BRI); 50 miles SW of Cooktown, 15°50'S 144°50'E, Jun 1969, *Wright* (BRI); Southedge, 17°01'S 145°23'E, Jun 1975, *Staples* IBS 2011 (BRI). NORTH KENNEDY DISTRICT: 40–50 miles S of Mt Garnet, Nov 1941, *Blake* 14429; (BRI, K); Burdekin River area, 20°19'S 147°17'E, Apr 1975, *Staples* IBS 2110 (BRI). SOUTH KENNEDY DISTRICT: "Yarrowmere" Stn, 21°30'S 145°50'E, Oct 1968, *Compton*, & Apr 1969, *Walker* (BRI).

3. *Atylosia mareebensis* Reynolds & Pedley, species nova affinis *A. marmorata* Benth. foliolatis angustioribus differt. **Typus: *Pedley* 2249 (BRI, holotypus, CANB, K, isotypi distribuendi).**

Repens planta annua vel perennis emoriens quoque annum; ramulosi costati villosi pilis patentibus usque 1 mm longis; stipulae 4 mm longae cordatae caducae. Folia dissita pinnate trifoliolata; petiolus ramulorum similis 2.5–12 cm longus; stipellae lineares circa 2 mm longae; petioluli villosi circa 2 mm longi; rhachis 8–14 mm longa; laminae anguste ovatae, acutae, 9–11 x 1.2–2.2 cm, reticulatae venosae in pagina infera, supra sparsim pubescentes vel ± glabrae et infra villosae in venis et glandulis sessilibus translucentibus flavidis praeditae. Flores in sparsis racemis usque 25 cm longis in axillis extremitatem ramulorum versus dispositi; pedicelli 1.5–5 mm longi a bracteis 2 mm longis subtenti. Calyx pubescens circa 1 cm longus corolla leviter brevior, lobis linearilanceolatis tubo 2plo longioribus. Legumina eorum *A. marmorata* similis.

Trailing annual or perennial dying back each year; branchlets ribbed, villous with spreading hairs up to 1 mm long; stipules 4 mm long, cordate, deciduous. Leaves scattered, pinnately trifoliolate; petiole similar to branchlets 2.5–12 cm long; stipellae linear, ca 2 mm long; petiolules villous ca 2 mm long; rachis 8–14 mm long; laminae narrowly ovate, acute, 9–11 x 1.2–2.2 cm, prominently reticulately veined on lower surface, pubescent or ± glabrous on upper surface, villous on veins and with sessile translucent pale yellow glands beneath. Flowers in open racemes to 25 cm long in axils towards the ends of the branchlets; pedicels 1.5–5 mm long, subtended by bracts 2 mm long. Calyx pubescent ca 1 cm long, slightly shorter than the corolla, lobes linear lanceolate twice as long as the tube. Pods similar to those of *A. marmorata*.

Queensland. COOK DISTRICT: Gorge Creek, 8 miles [13 km] W of Mareeba, Apr 1967, *Pedley* 2249 (BRI, CANB, K); Mareeba, Jan 1962, *Downes* 6202.1 (BRI).

Atylosia mareebensis is known only from two collections. It has been collected more recently in the type locality but neither flowers nor fruits were obtained. In habit, indumentum, texture of the leaves, and in the pods it is remarkably similar to the widespread *A. marmorata* but it differs in having narrowly ovate leaves.

4. *Atylosia pluriflora* F. Muell. ex Benth., Fl. Aust. 2:264 (1864). **Types:** Burdekin Expedition, *Fitzalan* (MEL); near Princhester *Bowman* (MEL); Thozet's River, *Dallachy* (MEL); Rockhampton, [*Thozet*] (MEL).

Low erect or procumbent shrubs 0.5–0.7 m high, all parts softly villous tomentose with white hairs; young leaves rusty tomentose on the nerves. Leaves digitately trifoliolate; petioles 1–2.5 cm long; leaflets elliptic to elliptic-obovate or obovate, 1.5–6.5 x 0.5–2.5 cm, tips obtuse, rarely acute, mucronate or emarginate, bases cuneate, glaucous above, pale below, drying dark grey, very rugose, soft; lateral nerves 5–7 pairs, oblique, ascending, arched at tips, impressed above; reticulate venation compact, raised below, bullate between reticulation and very hairy on the nerves; petiolules 1–2 mm long; stipellae absent. Inflorescences axillary, peduncles 2–8 cm long bearing a subumbellate raceme of about 7 flowers. Flowers 1.7 cm long; pedicels 0.5–1 cm long. Calyces 0.7–1.3 x 0.4 cm, lobes narrowly ovate, acuminate, flexuose, 0.5–0.6 cm long, rusty tomentose; petals 1.2–1.6 cm long. Pods 2–2.5 x 0.9 cm; villous tomentose; valves coriaceous with transverse grooves; seeds 3 or 4, oblongoid, reddish brown with pale specks; aril not as broad as the seed.

Eastern tropical Queensland. Common on hillsides among granite boulders in eucalypt forests. Flowers and fruits March to November.

Queensland. COOK DISTRICT: head of Emu Creek, S. of Irvinebank, Mar 1962, *Whitehouse*. NORTH KENNEDY DISTRICT: Herberton, Jan 1912, *Kenny*, Mar 1917, *Ringrose*, & Feb 1918, *Michael* 386; Ravenswood, Mar 1943, *Blake* 14875; Mt Stuart, May 1965, *Macfarlane*; Edwards I., May 1969, *Heatwole*; Hayman I., June 1934, *White* 10118. PORT CURTIS DISTRICT: Canoona, Sep 1943, *Blake* 15320, & Aug 1964, *Gillins* 879. LEICHHARDT DISTRICT: 20 miles SW of Rolleston, Mar 1959, *Tyson*.

Specimens from the Port Curtis District have somewhat smaller leaves than those from farther north.

5. *Atylosia lanceolata* W.V. Fitzg., Proc. Roy. Soc. West. Aust. 3:156 (1916). **Type:** Mt Broome, *Fitzgerald* (PERTH, holo).

Erect shrubs up to 3 m high, branchlets slender, pale yellowish or white silky tomentose with appressed hairs. Leaves unifoliolate or digitately trifoliolate, lateral leaflets absent on flowering shoots; petioles 0.5–2 cm long, leaflets narrowly oblong ovate or linear lanceolate 8.5–10 x 0.8 cm, tips obtuse usually with a short mucro, bases acute; densely tomentose, soft and rugose above; nerves prominent below, basal pair of lateral nerves arched and ascending uniting with others to form an intramarginal vein; petiolules 2–3 mm long. Inflorescences axillary, racemose, 0.5–1 cm long, usually 2–5 flowered, uppermost inflorescences occasionally forming a short terminal panicle through suppression of leaves. Flowers 8–10 mm long; pedicels 4 mm long. Calyces 6 x 3 mm, lobes lanceolate, acuminate, longer than tube, with appressed silky yellow tomentum. Petals 8–10 mm long, wings and keels shorter than standard. Pods oblong, 1.8–3.5 x 0.8 cm, tomentose, short hairs intermixed with pale long hairs; valves coriaceous with transverse depressions between the seeds; seeds 3–5.

Limited to the Kimberley region of Western Australia, usually on rocky red loam and sandstone, on slopes. Flowers and fruits May to July.

Western Australia. Lawley River, Jul 1921, *Gardner* 1465 (PERTH); Bushfire Hill, Prince Regent River, Aug 1974, *George* 12291 (K, PERTH); 9 miles W. of Mt House, Jul 1959, *Lazarides* 6447 (PERTH); Camballin, May 1970, *Power* 930 (PERTH).

6. *Atylosia acutifolia* (F. Muell. ex Benth.) Reynolds & Pedley, comb. nov. Based on *Rhynchosia acutifolia* F. Muell. ex Benth., Fl. Aust. 2:266 (1864). **Type:** Upper Victoria River, Feb 1856, *Mueller* (MEL 61477; lectotypus novus). *Rhynchosia quadricullosa* Domin, Biblioth. Bot. 89:228 (1926). **Type:** Savannenswalder bei Pentland, Mar 1910, *Domin* (PR, not seen; BRI, photo).

Erect shrubs to 2 m; branchlets with appressed tomentum. Leaves pinnately trifoliate; petioles 0.6–4 cm; rachises 0.7–1.5 cm long; leaflets ovate-elliptic acuminate or elliptic, 3.5–5 x 0.8–2.5 cm, tips acuminate, acute, rarely obtuse, bases acute or obtuse and rounded, suboblique on lateral leaflets, tomentose to subglabrous and copiously resin-dotted on both surfaces, semicoriaceous, discolorous, darker green and often with silvery sheen above, not rugose; nerves very fine, lateral ones 4–7 pairs, obliquely arched, reticulate venation lax, very fine; terminal petiolules 0.8–1 cm long, lateral ones 2–4 mm. Inflorescences axillary, 1–3 in each axil, 2–9.5 cm long; peduncles 1.5–7 cm long, slender, bearing a subumbellate raceme of 5–10 flowers towards their tips. Flowers yellow, about 1.2 cm long; pedicels 6 mm long. Calyces subcampanulate, 6–7 x 3 mm, resin-dotted and tomentose outside, tube 3 mm long, lobes ovate, usually acuminate, 3–4 mm long. Petals to 1 cm long, standard red-streaked. Pods 2–2.5 x 0.8 cm, apiculate at the oblique apex, narrow at base, valves coriaceous with oblique or straight grooves, tomentose with short hairs; usually 2 or 3 seeded (rarely 4), seeds oblongoid, aril not as broad as seed.

Ranges from the southern part of the Kimberley region and northern part of the Northern Territory to about 22°S latitude in Queensland, on rocky outcrops and gullies or on sand. Flowers and fruits February to October.

Western Australia. Camballin, May 1970, *Power* 869 (PERTH). **Northern Territory.** Daly River, township area, *Robinson* C.S.R. 1 (NT); Coomalie Creek, 13°02'S 131°07'E, Mar 1974, **Parker* 363 (BRI, NT); 11 miles S of Katherine, Feb 1961, **McKee* 8488 (BRI); Groote Eylandt, Jul 1972, *Dunlop* 2645 (BRI, NT); Sir Edward Pellew group, 15°43'S 136°49'E, Feb 1976, *Craven* 3815 (BRI); McArthur River area, 16°40'S 135°51'E, May 1976, *Craven* 3979 (BRI); 30 miles S of "McArthur River" Stn, Jul 1948, *Perry* 1722 (BRI). **Queensland:** BURKE DISTRICT: Mt Isa, Mar 1949, *McFarlane* (BRI), May 1952, *Morris* (BRI), & Oct 1974, *Specht & Rogers* 74 (BRI); Adels Grove, Jun 1947, *de Lestang* 374 (BRI) & Feb 1948, *de Lestang* 400 (BRI). GREGORY NORTH DISTRICT: Duchess, Feb 1931, *Hubbard* 7374 (BRI, K). COOK DISTRICT: 53 miles W of Georgetown, Jul 1960, *Trapnell* 220 (BRI); Laura River area, May 1975, **Byrnes* 3296; Rocky Tate River crossing, Etheridge Railway, Feb 1922, *White* 1354 (BRI). NORTH KENNEDY DISTRICT: Red Falls area ca 40 km WNW of Charters Towers, Jul 1974, *Jacks* (BRI).

Specimens with an asterisk in those cited above differ from the rest in being less pubescent (and therefore appearing greener) and having pods with 1 or 2 seeds with oblique transverse grooves between them. They represent a variant found on sandstone in both the Northern Territory and the southern part of Cape York Peninsular which may be an incipient subspecies.

The sheet MEL 61477 is chosen as the lectotype because other sheets MEL 61476 and MEL 61478 which bear the same collecting data do not match the description of *Rhynchosia acutifolia*. They are probably *Rhynchosia* sensu stricto. Another syntype of *R. acutifolia* (Nichol Bay, Gregory) is *Atylosia pubescens*. The Gilbert River specimen is too fragmentary to be considered as a type and we did not see the Cunningham specimen cited by Benth.

Benth noted in the protologue to *Rhynchosia acutifolia* that a pod with the specimen from Gilbert River had 3 ovules but that all ovaries he examined had only 2 ovules. In fact pods occasionally have four seeds and *R. acutifolia* is better placed with species of *Atylosia* than referred to *Rhynchosia*.

7. *Atylosia cinerea* F. Muell. ex Benth., Fl. Aust. 2:264 (1864). Type: Upper Victoria River, *Mueller* (MEL 47634, lectotypus novus).

Sparse, grey, densely hairy shrubs to about 2 m high, erect or straggly; branchlets softly white tomentose with silvery short close floccose hairs. Leaves pinnately trifoliate; petioles 1.2–3 cm; rachises 3–8 mm long; leaflets elliptic ovate 2–6.5 x 1.2–3.5 cm, tips obtuse, acute or rarely retuse, bases obtuse, discolorous, rugose, both surfaces softly velvety tomentose, with prominent resin glands; lateral nerves 5–7 pairs, oblique, subparallel, prominent and hairy above, reticulate venation not raised below; terminal petiolules 0.3–1.2 cm, lateral ones 0.3–0.5 cm. Inflores-

cences axillary, solitary, 1–5 cm long, racemose, usually 4–10 flowered, peduncles 1.7–4 cm long, slender. Flowers yellow, to 2 cm long; pedicels stout, 0.5–0.7 cm long. Calyces campanulate, 1 cm long, velvety, lobes subequal, short, to 5 x 2 mm, ovate, obtuse or acute, usually ribbed. Petals to 2 cm long, standard yellow with brownish streaks. Pods 2.5–3 x 1 cm, velvety tomentose with short hairs; seeds 4–6, broadly oblong, reddish brown with dark specks, aril not as broad as the seed.

Ranging from about 118°E to 134°E longitude but most frequently collected in the basins of the Fitzroy and Victoria Rivers. It often occurs on limestone soils and outcrops in eucalypt woodland. Flowers and fruit April to August.

Western Australia. Near "Woodstock" Stn, in-1952, *Suijendorp* 18 (PERTH); Grant Range, May 1965, *Beard* 4225 (PERTH); Geikie Gorge, Fitzroy River, Aug 1965, *Beaughlehole* ACB 11178 (PERTH); & May 1974, *Beard* 6953 (PERTH). 9.5 km SE of "Elquistro" H.S., N.E. Kimberleys, Mar 1978, *Lazarides* 8725 (BRI, CANB). **Northern Territory.** 107 km from Tanami (19°20'S 129°E), Aug 1971, *Gittins* 2289 (BRI); 51 miles N of Tennant Creek, Apr 1948, *Perry* 643 (BRI).

A lectotype has been chosen so as to exclude the other syntype (Nichol Bay, *Gregory*). This is the same as one of the syntypes of *Rhynchosia acutifolia* from the same locality and both specimens are referred to *A. pubescens*.

8. *Atylosia latisejala* Reynolds & Pedley, nom. et stat. nov. Based on *A. grandifolia* F. Muell. ex Benth. var. *calycina* Benth., Fl. Aust. 2: 264 (1864). **Type:** Victoria River, *Mueller* (MEL, iso).

Spreading, grey, densely hairy shrubs to 1 m high, branchlets villous tomentose. Leaves pinnately trifoliate; petioles 1–4 cm; rachises 4–8 mm long; leaflets elliptic-ovate or elliptic, 1.5–6.5 x 0.8–3 cm, tips obtuse, bases rounded, subcordate or obtuse, rugose especially above, tomentose on both surfaces, lower surfaces strongly reticulate with white, raised, compact reticulations, bullate between nerves, impressed above, lateral nerves 4–5 pairs, oblique; terminal petiolules 0.5–1.5 cm, lateral ones about 3 mm long. Subumbellate racemes axillary, solitary, 3.5–7 cm long, usually 4–8 flowered, peduncles 0.5–2 cm, long. Flowers yellow, about 1.5 x 0.5 cm; pedicels 0.6–1.2 cm, slender. Calyces 1.4 x 0.5 cm, softly villous tomentose, lobes oblong-ovate-acuminate with a midrib, concave, pink, longer ones up to 0.3 cm wide. Petals about 1.2 cm long, standard with red streaks, broadly obcordate. Pods about 1.7 x 0.8 cm, densely villous with pale hairs, seeds usually 2(–4), obovoid, reddish brown with pale streaks, aril narrower than seed. Fruiting calyx lobes showy, pink, persistent.

Common on sandy rocky soil on upper slopes of sandstone ranges and hills in open grassland. Flowers and fruits April to October.

Northern Territory. Keep River area (15°46'S 129°02'E), Sep 1975, *Henshall* 1100 (BRI); Jasper Gorge, Victoria River (16°02'S 130°41'E), Oct 1958, *Chippendale* NT 5035, & Sep 1974, *Parker* 459 (DNA); "Kildurk" Stn, May 1969, *Byrnes* 1566 (DNA). **Western Australia.** "Ivanhoe" Stn, N.E. Kimberleys, *Langfield* 382 (PERTH); 16 km S of Kununurra, Aug 1968, *Blockley* 886 (PERTH); Deception Range, E. Kimberleys, May 1971, *Byrnes* 2214 (DNA, PERTH); Middle Springs, Deception Range, Apr 1956, *Burbridge* 5161 (PERTH); Milligans Lagoon, E. Kimberley, Jun 1937, *Stokes* 21 (PERTH); 11 km E of "Dunham [? Denham] River", Stn, Jul 1949, *Perry* 2525 (BRI, PERTH); Brook Creek, Ord River, May 1944, *Gardner* 7213 (PERTH); Button's Gap, Lower Ord River, Jun 1944, *Gardner* 7420 (PERTH); near Alligator Springs, 110 km E of "Carlton" Stn, Jul 1949, *Perry* 2617 (BRI, PERTH).

Atylosia latisejala is a distinctive plant, particularly when in fruit, but it is closely related to both *A. reticulata* and *A. pubescens*. Intermediates between it and *A. reticulata* do occur where their ranges adjoin but despite this specific rank seems to be justified.

9. *Atylosia reticulata* (Dryander) Benth., Fl. Aust. 2:263 (1864). Based on *Dolichos reticulatus* Dryander in Aiton, Hort. Kew. ed. 1. 3:33 (1789). **Type:** Endeavour River, Jun-Aug 1770, *Banks & Solander* (BM, holo).

Atylosia grandifolia Benth., Fl. Aust. 2:264 (1864). **Types:** Port Denison, *Dallachy* (MEL, iso); Burdekin Expedition, *Fitzalan* (MEL, iso).

Shrubs usually erect or scandent to 2 m high, sometimes spreading to 0.7 m wide; branchlets rusty tomentose or hoary tomentose. Leaves pinnately trifoliolate; petioles 1.5–6 cm long; rachises 0.5–3 cm; leaflets elliptic ovate, broadly ovate, rhomboidal or subobtusate, 2.5–11.5 x 2.5–7 cm, tips acute, obtuse or rounded, bases obtuse or subcordate, semicoriaceous, subrugose, puberulent, pubescent or white tomentose. Inflorescences 1–5 per axil, racemose. Flowers yellow, 0.5–1.4 cm long; pedicels at first short, 0.5–1.2 cm long, slender. Calyces 1.6–2 cm long, densely villous, lobes linear, subulate, flexuose, the upper ones about 3 times as long as the tube, laterals shorter. Petals *ca* 1.4 cm long. Pods 2–3 x 0.6–1 cm, tomentose, valves coriaceous, grooves oblique to transverse; seeds 2–5, obovoid or oblonged, aril narrower than the seed.

The most widely spread and most variable of the Australian species of *Atylosia*, ranging from the Cambridge Gulf area of Western Australia to the Burnett District of Queensland. Two subspecies are recognised, one restricted to the north-western Gulf of Carpentaria. Variation within one of these is considerable but formal recognition of other variants is not warranted.

9a. *A. reticulata* subsp. *reticulata*

Stems erect or scandent, branchlets rusty tomentose. Petioles 2.2–6 cm; rachises 0.6–3 cm; leaflets 4.5–11.5 x 2.5–7 cm, elliptic ovate, broadly ovate or rhomboidal with acute or obtuse tips, pubescent or puberulent, semi-coriaceous, subrugose, lateral nerves 4–7 pairs, reticulate venation lax, fine, slightly impressed above. Inflorescences 1–5 per axil, 2.5–12.5 cm long, peduncles 1–7 cm long bearing a subumbellate raceme of 6 or 7 flowers, upper peduncles short, forming an irregular terminal panicle. Flowers yellow, 1.5–1.8 cm long, pedicels 0.5–1.2 cm long, slender. Calyx lobes linear, subulate, flexuose, rusty villous tomentose. Pods 2.5 x 0.8 cm, 2–5-seeded, valves coriaceous, rusty villous tomentose.

Wide ranging in low eucalypt communities and grassland, sometimes on limestone.

Western Australia. Deception Range, Feb 1950, *Langfield* 170 (PERTH). **Northern Territory:** Daly River, 1 mile N of "Florina", Sep 1968, *Robinson* CSR 65 (NT); 57 miles S of Darwin, Jun 1969, *Byrnes* 1412 (NT); Katherine Gorge, Mar 1964, **Lazarides* 7030 (BRI, PERTH); 57 miles E of Pine Creek, Feb 1969, **Byrnes* 1392 (NT). **Queensland.** BURKE DISTRICT: Settlement Creek 30 miles from Coast, June 1958, *Perry* 119 (BRI). COOK DISTRICT: Dinner Creek on Silver Plains-Coen Road, Nov 1956, *Webb* 3200 (BRI); Mossman River, Feb 1932, **Brass* 2151 (BRI); Parada, Feb 1958, *Keefer* 43 (BRI); Watsonville, Feb 1962, *Hyland* AFO 2808 (BRI). NORTH KENNEDY DISTRICT: Near Cardwell, 18°13'S 145°56'E, Jan 1976, *Thorsbourne & Thorsbourne* 138 (BRI); Mt Saunders near Yabula, Aug 1942, *Smith* T109; Proserpine, Mar 1935, *Macpherson* 757 (BRI). LEICHHARDT DISTRICT: Expedition range, Aug 1960, *Gittins* 362 (BRI). PORT CURTIS DISTRICT: 7.3 miles E of Marlborough, Aug 1963, *Speck* 1756 (BRI). WIDE BAY DISTRICT: Biggenden, Oct 1930, *White* 7295 (BRI).

A lax-flowered variant is included in this taxon. It has graceful inflorescences and thin acute leaves which are not rugose. All specimens seen are marked with an asterisk above.

9b. *A. reticulata* subsp. *maritima* Reynolds & Pedley, subsp. nov.

Caules prostrati incanotomentosi pilis albis. Folioli 2.5–4.2 x 2.5–3.7 cm rhomboidei vel suborbiculares apicibus rotundatibus vel obtusis dense albotomentosi molles, leviter rugosi 3 paribus nervosum lateraliū praediti. Racemi apicibus ramulosum longorum usque 2.5 cm longi pendunculis tenuibus. Flores viride flave *ca* 1.5 cm longi; pedicelli 0.8 cm longi; calyces lobi flexuosi subulati albotomentosi. Legumina *ca* 3 x 1 cm, 3–4 seminibus valvis coriaceis albotomentosis. **Typus:** *Specht* 714 (BRI, holotypus).

Stems prostrate, spreading, hoary tomentose with white villous hairs. Petioles 1.5–4 cm; rachises 0.5–1 cm; leaflets 2.5–4.2 x 2.5–3.7 cm, rhomboidal or suborbicular with rounded or obtuse tips; densely white tomentose, soft, slightly rugose,

lateral nerves 3 pairs, lowermost pair oblique with arched side nerves, reticulate venation impressed above, slightly raised below. Racemes solitary at the tips of long lateral branchlets, 4.5–16.5 cm long, peduncles slender 1–10 cm. Flowers bright yellow, ca 1.4 cm long; pedicels 0.8 cm long; calyx lobes flexuose, subulate, white tomentose. Pods ca 3 x 1 cm, 3 or 4-seeded, valves coriaceous, white tomentose.

Groote Eylandt and adjacent coasts of Arnhem Land, common on coastal dunes, forming sprawling clumps. Flowers and fruits April to July.

Northern Territory. Port Bradshaw, Jul 1948, *Specht* 714 (BRI), Bickerton I., Jun 1948, *Specht* 503 (BRI); Groote Eylandt, Apr 1948, *Specht* 258 (PERTH) & 277 (BRI, PERTH).

There are several specimens from the Northern Territory and Western Australia with the general appearance of *A. reticulata* and broadish sepals approaching those of *A. latisejala*. They were collected where the ranges of the two species adjoin and may indicate some gene exchange between them.

Western Australia. King Leopold Ranges, 8.5 miles SE of "Bedford Downs" Stn, Jul 1960, *Lazarides* 6378 (CANB); about 1 mile N of mouth of Revolver Creek, base of the southern Carr Boyd Range, 16°14'S 128°34'E, Mar 1978, *Hartley* 14540 (CANB, NT). **Northern Territory.** 101 miles SE of "Carlton" Stn, Jul 1957, *Perry* 3008 (BRI, PERTH)

10. *Atylosia pubescens* (Ewart & Morrison) Reynolds & Pedley, comb. nov. Based on *Tephrosia pubescens* Ewart & Morrison, Proc. Roy. Soc. Victoria 26 n.s.:163 (1913); Ewart & Davies, Flora North. Terr.:147 (1917). **Type:** Top Spring, Aug 1911, *G.F. Hill* 535 (MEL).

Erect grey shrubs to 2 m, branchlets softly tomentose with thick appressed hairs or with long spreading hairs. Leaves pinnately trifoliolate; petioles 1–6.5 cm; rachises 2–6 mm long; leaflets obovate-elliptic to elliptic, 2–5 x 1.2–3.5(–4) cm, tips obtuse, rounded or mucronate, bases obtuse, discolorous, rugose, tomentose, hairs sometimes long, upper surfaces with a silvery sheen; lateral nerves 5–7 pairs, deeply impressed above, reticulate venation, compact, prominent and raised below, bullate between nerves; terminal petiolules 0.5–1.5 cm, lateral ones 0.2–0.5 cm. Inflorescences axillary, solitary, racemose rarely paniculate, 3–19 cm long; peduncles 2.5–9 cm long, rarely branched, stout, rusty tomentose, usually exceeding the leaves and bearing a compact subumbellate raceme of 6–10 flowers towards their tips. Flowers yellow 1.5–2 cm long; pedicels 1–1.5 cm long, stout. Calyces campanulate, 1–1.5 x 0.5 cm, rusty villous, resin-dotted, lobes ovate or narrowly ovate, acuminate, 0.5–0.8 cm, tube 0.3–0.5 cm. Petals 1–1.8 cm long, standard with dark reddish veins. Pods 2.5–3.5 x 0.8–1 cm softly tomentose with long and short hairs, valves coriaceous with usually oblique, transverse grooves between the seeds; seeds 3–5, broadly obovoid, reddish brown with dark specks; aril not as broad as the seed.

A variable species which ranges from Nichol Bay to Cloncurry with one specimen from Ajana some 700 km south of the nearest collection locality, the Hamersley Range. One variant known from only two collections, is described as a new variety.

10a. *A. pubescens* var. *pubescens*

Indumentum of stems appressed and of leaves rather short.

Western Australia. Ajana, Sep 1958, *D.H. Perrys* s.n. (PERTH); Wittenoom Gorge, May 1952, *Birkways* s.n. (PERTH), Sep 1957, *Stewart* s.n. (PERTH) & Jul 1958, *McMillan* s.n. (PERTH); Dolphin I., Dampier Arch., Jun 1962, *Royce* 7164 & 7224 (PERTH); between Liveringa & Mt Anderson, Feb 1953, *Broadbent* 681 (PERTH); Lennard River, 10 miles above junction with Barker River, May 1905, *Fitzgerald* 580 (PERTH); Fitzroy Crossing, May 1927, *Ewart* s.n. (PERTH); 8 miles SE of Halls Creek, May 1944, *Gardner* 7163 (PERTH); King River Gorge, ± 15 km SW of "Bedford Downs", Jun 1976, *Beaglehole* 53652 (NT); Bindoola Creek, El Questro-Gibb River road, ± 55 km SW of Wyndham, May 1976, *Beaglehole* 51373 (NT); Ord River Gorge, Jun 1944, *Gardner* 7336 (PERTH). **Northern Territory.** 53 km SW of "Victoria River" H.S., 16°38'S 130°42'E Jun 1974, *Latz* 5307 (DNA); Cox River, 16°01'S, 134°46'E, Jul 1977, *Henshall* 1683 (BRI, CANB); McArthur River area, 16°32'S, 136°, Jun 1976, *Craven* 4084 (BRI, CAN); 30 miles S of McArthur River, Jul 1948, *Perry* 1690 (BRI); Settlement Creek, Jan 1948, *Perry* 1197

(BRI). Queensland. BURKE DISTRICT. "Riversleigh", Jun 1963, *Gittins* 802 (BRI) & Jun 1966, *Pedley* 2063 (BRI); Corella Dam near Cloncurry, Aug 1959, *Sillar* s.n. (BRI); Fountains Springs area, 25 km S of Mary Kathleen, 20°58'S 139°56'E, *Farrell* TF 873 (BRI).

10b. *A. pubescens* var. *mollis* Reynolds & Pedley, var. nova

differt ab *A. pubescens* var. *pubescens* indumento caulium et petiolorum longo effuso et foliorum longiore molle. Legumen ignotum. **Typus:** *Cole* et al. 9098 (BRI, holotypus).

Differs from var. *pubescens* in the indumentum of the stems and petioles being long and spreading, and of the leaves soft and longer. The pods are unknown. Type: *Cole* et al 9098 (BRI, holo).

Collected only in the Cloncurry area in mineralised areas. Flowering in April and July.

Queensland. BURKE DISTRICT: 2 miles S of "Wee McGregor" mine [near Ballara approx. 21°S 140°E] growing over schistose rocks, Jul 1974, *Cole* et al. 9098 (BRI); 13 miles on road to Ballara, Apr 1974, *Cole* et al 9013 (BRI).

Though *A. pubescens* var. *mollis* is a distinctive plant it has been collected only twice. Until more material, including fruits, is seen we prefer to take a rather broad view of *A. pubescens* and place it there.

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